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Industrial Research

Research in industry may take any one of several forms—Laboratory control of shop processes — Instances of practical results from fundamental research

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General Electric Co.

INDUSTRIAL research is the systematic pursuit of knowledge useful to industry. To industrial corporations it is what higher education is to individuals, a necessity to some, a valuable asset to many, but generally regarded as a prohibitively expensive and needless luxury to others.

The doctor or the engineer, whose work constantly presents new problems requiring for their solution resourcefulness based on highly specialized knowledge, would be helpless without technical training, while the bricklayer or plumber may succeed with only the familiarity with the methods of his trade which practice gives. So an industry in which the production problems involve complex scientific principles in physics and chemistry, as in the manufacture of cameras and photographic supplies, or in which new and widely varying problems are continually encountered, calling for new devices, new designs, new materials and new processes, as in the case of a large electrical manufacturing corporation, finds a research laboratory an indispensable part of its organization, while another industry, utilizing only well known materials and performing only well known mechanical operations, as perhaps is true for the most part of the manufacture of wooden furniture, might consider a research laboratory of insufficient utility to justify its cost.

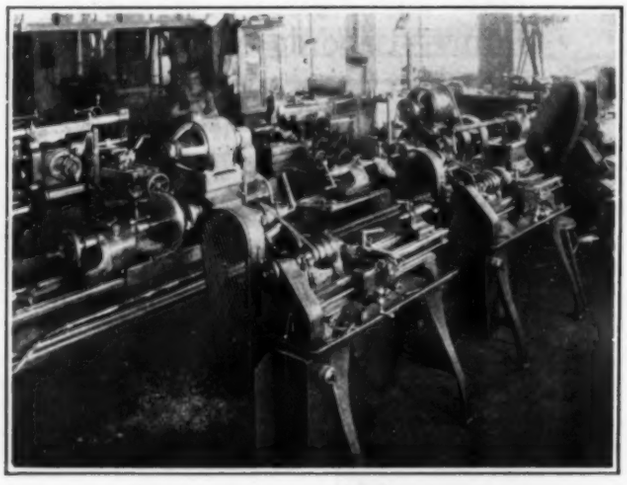
Dr. W. R. Whitney, Director, General Electric Research Laboratory

Just as between the doctor and the bricklayer there lies a wide range of professions, businesses and trades, in which more or less of the so-called "higher education," or one kind or another of specialized or technical training, may be of value, so between the industry dealing with complex chemical reactions and the industry dealing with wood-turning, there is a wide range of manufacturing processes in which one kind or another of research laboratory may have utility.

The research laboratory is the least standardized department of industrial organization. According to the nature of the industry it serves, the laboratory should and does vary in its relation to other departments, in its internal organization, in the nature and extent of its facilities, in the character of its work, and in the relative prominence, in its investigations, of pure science, practical problems, and engineering development.

Thus in some corporations the research department has taken over the functions of engineering development and design, carrying the full responsibility for all devices until they are turned over to a factory department with complete engineering specifications and drawings. Such a system has the advantage of minimizing friction and delay, by eliminating the necessity of "selling" a new device to another department and perhaps subjecting it to redesign or temporary neglect before its production can be begun. In other corporations the research laboratory is entirely distinct from the designing engineering department. Its function is that of a service department,

to help the engineers in their special problems, and to supply them with new principles and new materials to enable them to produce new devices or improve their old. This arrangement has the advantage that the research laboratory, freed from direct responsibility for meeting immediate commercial requirements, which in all departments responsible for them must always be given precedence over developments for the future, may conduct its research and development programs with less



The experimental machine shop

interruption and hence with greater efficiency and perhaps with a perspective clearer, because less disturbed, and broader, because the viewpoint is more detached.

The greater the variety of the product of a corporation, the less practicable becomes the complete amalgamation of research and engineering. Incandescent lamps, switchboards and steam turbines could hardly be handled efficiently by a single engineering department. At the same time, such variety of product calls for research in fundamentals of general application and a broad vision in planning the work. Therefore, in general, the detached laboratory seems best suited to the needs of a corporation with highly diversified product, while the intensive research, which is most efficient when closely knit with engineering development, seems most helpful to the corporation specializing in a more restricted field.

Similar considerations probably determine the degree to which direct laboratory control of factory processes is desirable. The more diversified the processes, the more difficult it becomes to centralize the control.

These differences in the part played by the research laboratory in different types of industry require differences in internal organization. When the laboratory is directly responsible for engineering development to meet immediate commercial requirements, or for the processes of commercial production, a definite allocation of responsibilities is essential, so that some rigidity of organization and autocracy of control are required. When the laboratory's activities are confined chiefly to research, a much looser and more democratic association of co-operating groups is sufficient and possesses greater flexibility in conforming to the continuous change of problems which characterizes research.

But greatest of all differences resulting from the differing relations of the laboratory to the rest of the organization is that in the nature of the work. Of course, one laboratory may be dealing chiefly with physics, another with organic chemistry and a third with metallurgy, but that is not the kind of difference me mean. More fundamental differences result from the nearly exclusive attention given in some laboratories to specific developmental or production problems, and the greater emphasis in other laboratories on purely scientific work.

The work of any industrial research laboratory must involve some pure science, some developmental work, and some work on immediate practical problems, for every laboratory must occasionally experiment solely to obtain new knowledge which it needs; it must develop, partly at least, new devices or processes in order to embody its new knowledge in practical form; and, whether carrying direct responsibility for engineering and production, or serving only as an aid to the responsible departments, it must, to justify its existence, be ever ready to contend with immediate practical problems which are continually arising in industrial processes.

Concentration on Specific Subject

But the type of laboratory most useful to a corporation working in a restricted field must necessarily confine its energies primarily to intensive research in that field, to the direct effort to improve the company's product. Scientific investigations cannot wisely be permitted to diverge too far from the concrete problems of production. The laboratory serving a corporation with highly diversified products has properly a much broader field for scientific work, for there is a much greater probability that any new scientific discovery will find a useful application somewhere within the company's field of interest.

For instance, in the laboratory of the General Electric Co., methods developed for studying and analyzing vibrations have been found applicable to steam turbines, in which vibrations in the bucket wheel caused the edges of the buckets to rub on the stationary part; to radiotrons, in which vibration of the filament produced a microphonic effect; to railway motors, in which vibration of the armature produced fatigue effects and breaks in the commutator leads; to the coiling machines for winding the filament coils for incandescent lamps, in which vibrations produced variation in the tension, and consequently in the stretching, of the wire as it was coiled, which in turn produced hot spots in the filament and short life; to small alternating current motors in which vibrations caused undue noise; to condensers used in radio sets, in which vibration of the condenser plates produced "howling;" and to lamp sockets in locations where vibrations caused early rupture of the filaments of the lamps burned in those sockets.

Not only in the fields of laboratory technique and manufacturing process have diverse applications of a single new thing been found. It has proved true of the results of scientific studies seemingly quite remote from practical problems. For instance, a study of the so-called "Edison" effect, a discharge between the terminals of a hot filament in a relatively poor vacuum, was undertaken to find why it was that the phenomenon occurred only when the vacuum was poor, and whether the commonly accepted view was right, that the discharge resulted from some chemical reaction between the residual gas and the hot filament. This study led not only to a proof that the common view was wrong

and to the discovery of a new principle, the "Space charge" effect, but also to a huge train of practical applications of the "pure electron discharge." Among those applications have been the Coolidge X-ray tube which has transformed the whole X-ray art, the high power pliotron which has made radio broadcasting possible, the high voltage kenotron which has afforded a type of high voltage rectifier, and other high power tubes.

Two other scientific studies, one on the rate of evaporation of hot tungsten and the other on the loss of heat from small wires in air, combined to lead to the Mazda C lamp, unthought of when these studies were begun.

The chance that a given discovery will find application in a given product is directly proportional to the diversity of that product. Therefore the broader a company's interests the greater the latitude it can afford to allow its research laboratory in conducting general scientific work with no practical problem in view.

But however much scientific work is economically justified, its justification would vanish were the laboratory not prepared to supplement its scientific discoveries with engineering development of the new devices which those discoveries make possible.

Thus, in the laboratory from which the foregoing examples have been taken, nearly all the devices mentioned—Coolidge tubes, pliotrons, kenotrons, tungar rectifiers, photoelectric cells, tungsten contacts and other tungsten parts, were not only designed and developed but were actually manufactured by the laboratory until production reached sufficient quantity, and technique of manufacture was sufficiently developed, to justify turning them over to factory departments.

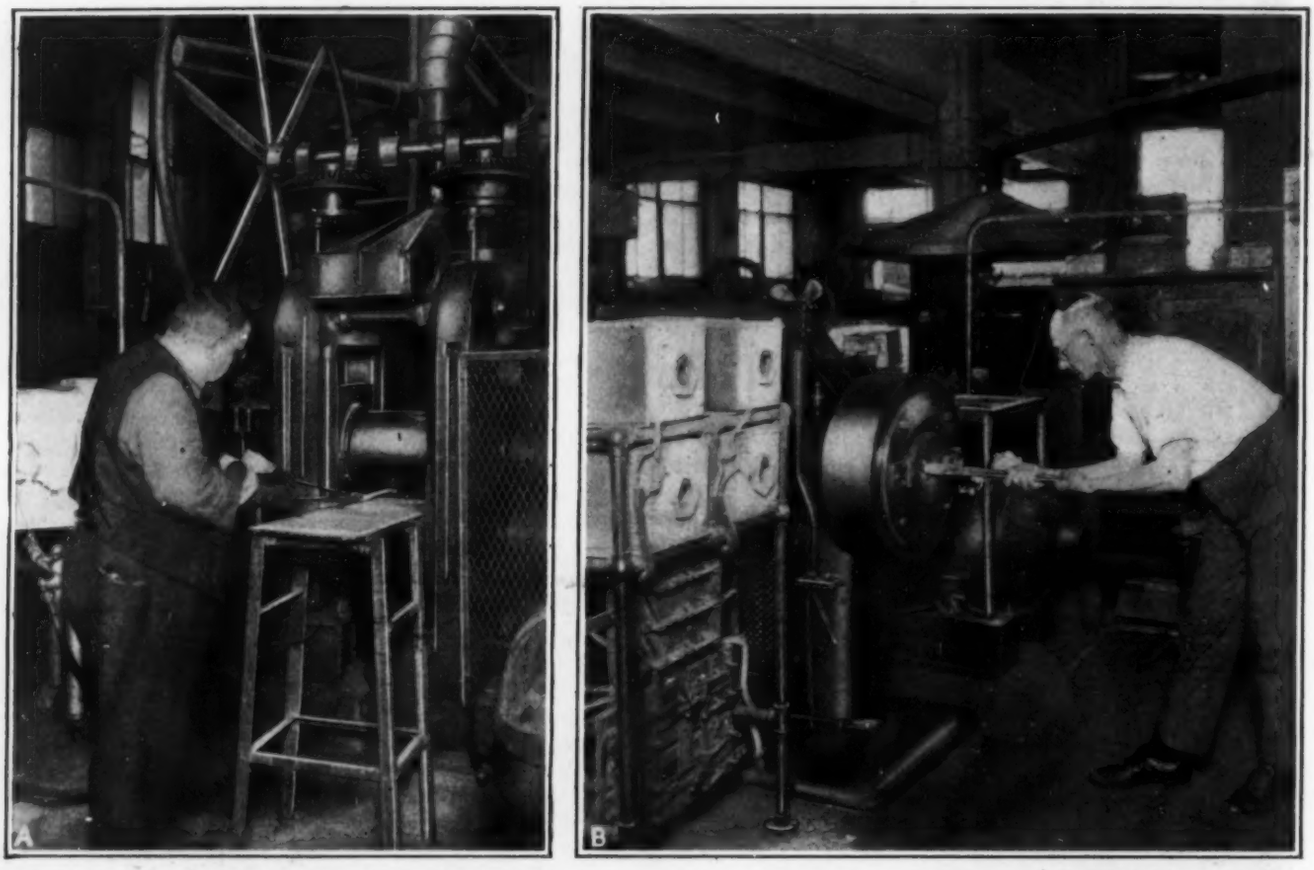
Although the scope of a company's interest may determine the value to it of scientific work of a general character, the utility of research when brought to bear on a practical problem is unaffected by diversity of product but is measured solely by the importance of the problem to the company. Indeed a small improvement in quality or reduction in cost may be of more value to the company specializing in a restricted field, as the gain is ordinarily spread over a higher percentage of its product.

Sometimes a problem admits of a definite and, for the time being, final solution. At other times all that can reasonably be expected is an improvement, which may be enlarged from time to time by further research, but with the absolute solution still remote. Examples may be taken from the field or wire insulation. A fine copper wire with a very thin enamel film, of uniform thickness and complete continuity, has been needed for years for meter armatures, but the demand has enormously increased with the development of the radio art and its requirements for inter-stage transformers and loud speaker coils. The finer the wire, the more difficult it is to get a uniform thickness of enamel film, unless that film is made very thin indeed, and in that case its continuity is liable to interruption by projecting silvers formed on the wire in drawing and very difficult to remove. In consequence a large proportion of coils were rejected because of partial short circuits. Here the problem called for a perfectly definite solution, which was found by passing the wire through a suitable enamel, then through a diamond die which spread the enamel in a continuous, very thin film of uniform thickness, baking the film, and repeating the operation four or five times. The product was just what was desired, coil rejections disappeared, and research work could be definitely discontinued.

In contrast to this is the problem of the insulating varnish for the cotton-covered wire used in generator and motor coils. Time and temperature combined to oxidize the varnish film, so that it gradually became brittle and subject to slow disintegration under the vibrations to which it was subject. Intensive research,

A room in the Research Laboratory

extending over many years, on the oxidation and polymerization of varnish and on the technique of coil impregnation, has resulted in greatly increasing the "endurance" of the varnish, but the success has been necessarily one of degree, for the organic material that will withstand high temperature indefinitely is not in sight, and, as it is conceivable that the endurance may be still further increased, research is still continuing.



Laboratory methods of rolling tungsten sheets for vacuum tubes and swaging tungsten anodes for Coolidge tubes

Another example of this difference may be taken from the field of metallurgy. It was necessary to plate with copper some steel springs, but they were found after plating to be quite brittle. Investigation showed that the brittleness was produced by hydrogen permeating the steel during the electro-plating process. It was further found that tin was impervious to hydrogen. The simple expedient of tinning the springs before plating solved the problem.

High temperature corrosion offers a contrasting case. Through research, processes of applying protective coats of aluminum of chromium alloy were developed, but these coats have their limits of endurance, and, as higher operating temperatures are required, the general problem cannot be considered wholly solved, so there is room for further research.

Of course the expenditure for research must be limited by the possible profits of the business. Research is costly and this is specially true of research in pure science which, to be successful, requires workers of the highest ability and, usually, costly facilities, if not for the initial scientific investigation, then for the development work requisite to reduce to practical form the results of the scientific studies. In those industries, therefore, which are conducted by many small and independent companies, research in pure science might seem prohibitively expensive, but it is just such scientific work with its supplementary development, of general interest to the industry, which is most suitable for a co-operative research organization. The solution of practical production problems usually requires close contact with the production itself and must therefore usually be left to the individual manufacturer, but the facilities needed for such work often consist only of a relatively small amount of special apparatus supplementary to the equipment already provided for production purposes, and so may be relatively inexpensive. The developments necessary to utilize the results of such special research are also likely to be far less expensive than those which result from new scientific discoveries and which are likely to depart more widely from standard practice.

Just as education for the individual may vary in character and extent, according to need, from a little special training in some trade up to an extensive induction in the arts and sciences, so research for the manufacturer may vary from the study by a small laboratory of his special production problems up to a comprehensive scientific investigation by a large laboratory staff of the fundamental principles and processes of the industry.

And just as it is undoubtedly true that some education of some kind is useful and profitable to every man, so is it probably equally true that some research of some kind, conducted by a laboratory of his own or through a co-operative trade organization, is useful and profitable to every manufacturer, for the development and perfection of his products.

Piston Rods and Rings for Air Pumps

By Fred H. Colvin
Editor, *American Machinist*

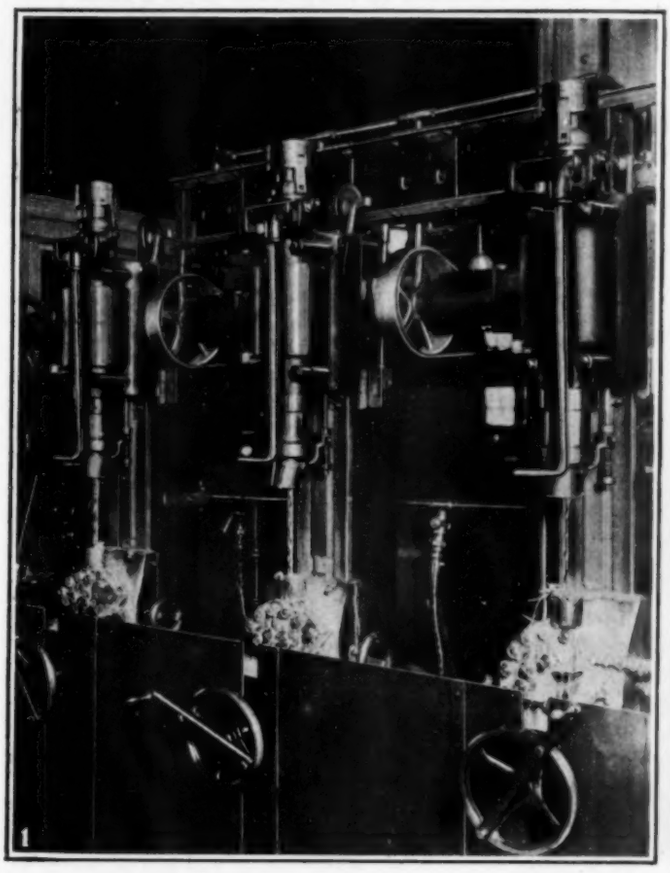
Measuring the tightness of fit between threaded parts by a hydraulic cylinder and gage—riveting rod ends and tooling for piston-ring work

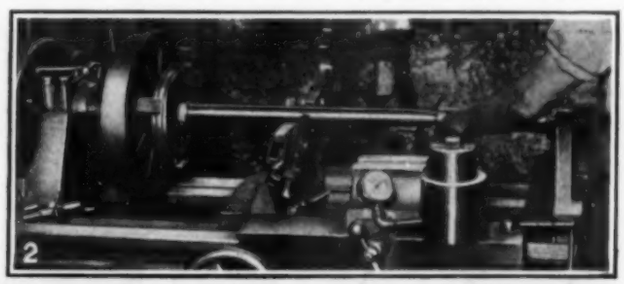
THE making of piston rods and fastening them into the piston is a real job in the building of air pumps, and the methods in use by the Westinghouse Air Brake Co., Wilmerding, Pa., are here given. The frequent and sudden reversals at the ends of the stroke necessitate both a good fit and every possible precaution against the piston head coming loose on the rod.

The piston rods are drilled for a portion of their length, the special machine shown in Fig. 1 being used for that purpose. The rods are clamped in substantial holders in the hollow spindles, each holder being able to handle rods of three diameters. This arrangement obviates the necessity of changing holders and allows the work to be changed from one size to another with a minimum loss of time.

A special 3-spindle drilling machine is used, a clutch being provided at the upper end of each spindle to enable the operator to throw it in or out of action at will. Special drills are used and stops are provided that throw out the feed when the desired depth of hole has been reached. The drills feed upward, the drill carriages being counterbalanced. The hand-control wheels extend through the splash guard, both for convenience and to keep them clean.

Some idea of the care exercised in fitting the piston rods into the piston heads may be had by noting the method shown in Fig. 2. The thread is white leaded, centered in the head and a suitable wrench attached to the outer end. The end of the wrench rests on a knife-edge across the top of the piston of what may be called a small hydraulic test pump. With the lathe turning slowly, the operator carefully notes the pressure on the gage, and in this way the power required to screw the piston rod into the head is measured, and the uncertainty of depending on the "feel" of the fit by the





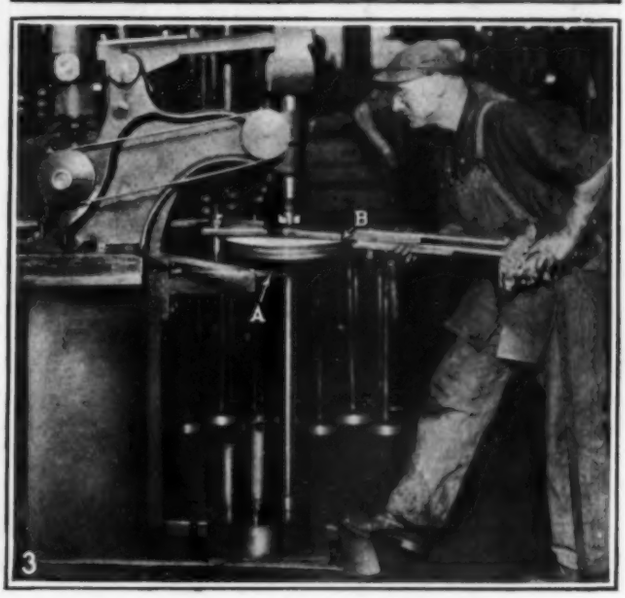


Fig. 1—Drilling the piston rods. Fig. 2—Gaging the pressure required to screw rods in heads. Fig. 3—Riveting the rod in the head

man, when parts are screwed together, is eliminated.

The outer end of the piston head is chamfered to allow room for riveting the end of the piston rod over, to still further insure against the possibility of its backing out while in service. Riveting is done under the small helve hammer shown in Fig. 3, rotation of the hammer head being secured by a worm gear operated by the belt shown.

The illustration shows how the piston rod is located against the support *A* and held against rebound by means of the bar *B*, the outer end of the bar being provided with a strap that comes under the operator's left foot. The fact that this operation produces considerable vibration is shown by the waste in the operator's hand to cushion its effect.

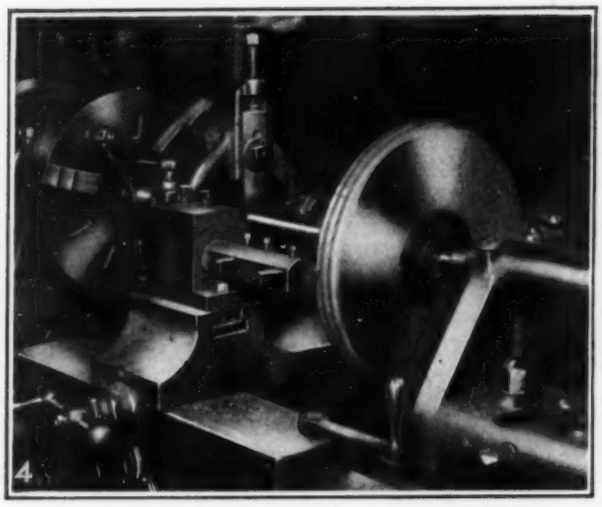


Fig. 4—Finish turning the piston head.

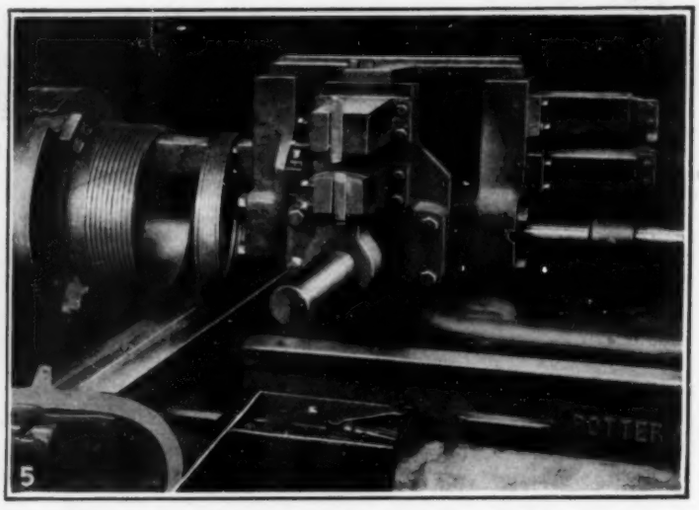


Fig. 5—Turning and boring piston rings

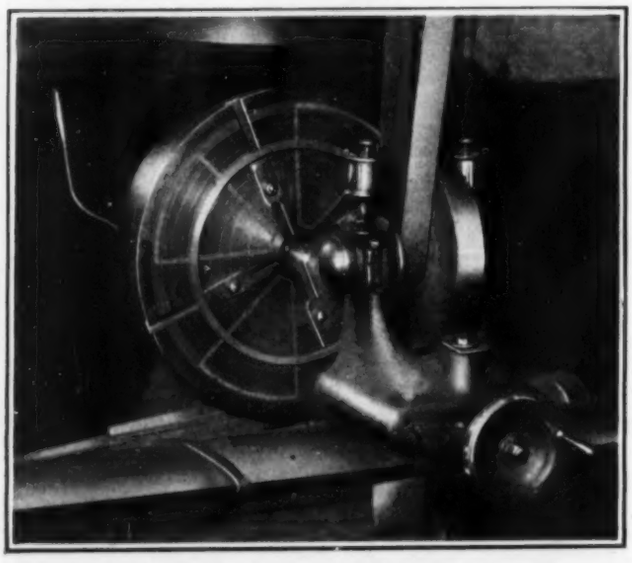


Fig. 6—Finishing the sides of rings

The appearance of the riveted end of the piston rod can be seen in Fig. 4, where the piston head is being finish turned in place on the rod, so as to insure both concentricity and squareness. The piston heads are rough turned on a Bullard mult-au-matic, but the final finishing of the ring grooves and outside diameter is done in place, as in Fig. 4. This illustration shows how both the turning and grooving tools are held in a substantial tool bar.

The piston rings are turned from a long pot on Potter & Johnston machines, as in Fig. 5, which also shows the tooling for simultaneously machining both the insides and outsides of the rings. The turret is piloted and the tops of the toolholders are supported by the tie piece shown. A multiple cutting-off tool is used on the cross slide, the tools cutting deeper at the outer end, as is customary. In this way, the outer ring drops off first and is caught by the support shown in position under the outer end of the pot. This view also shows the form of chuck jaws used in holding the beveled edge on the inner end of the pot and gives a clear view of the whole operation.

The rings are finished on the grinding machine shown in Fig. 6. The rotary magnetic chuck is mounted on a horizontal spindle as shown and the rings are ground in the usual manner.

To Discuss Automobile Factory Processes at Engineers' Convention

Recognizing that production engineers are just as important as design engineers, if the public is going to have good cars at low prices, the Society of Automotive Engineers is completing arrangements for a three-day national production meeting to be held in Cleveland, Sept. 14 to 16. The sessions are to be held coincident with the meeting of the American Society for Steel Treating and the steel exposition which is to be staged by that society in the new Public Auditorium. There are to be about 170 exhibits, and steels in the raw state will be shown passing through machine tools and heat treating processes to final inspection of the finished product. Nearly 100 exhibits of machine tools will be seen in operation under factory and production conditions.

One woman will be among the numerous speakers at the five technical sessions of the automotive engineering society. She is Mrs. Lillian Gilbreth, who has won international notice for her study and teaching of methods of training employees in production work. Col. J. B. Dillard and L. L. Roberts will give papers on machine tools, Louis Ruthenberg will tell of methods of training foremen, P. L. Tenney and another speaker at the gear session will tell of methods of making 70,000,000 in.-lb. to the rudder post.

Automotive Production

Maintaining Quality to the Standard of a Slogan

By John Younger
Associate Editor, *American Machinist*

Large percentage of old employees—Standard specifications and their function—What really rigid inspection means and what it accomplishes in quality

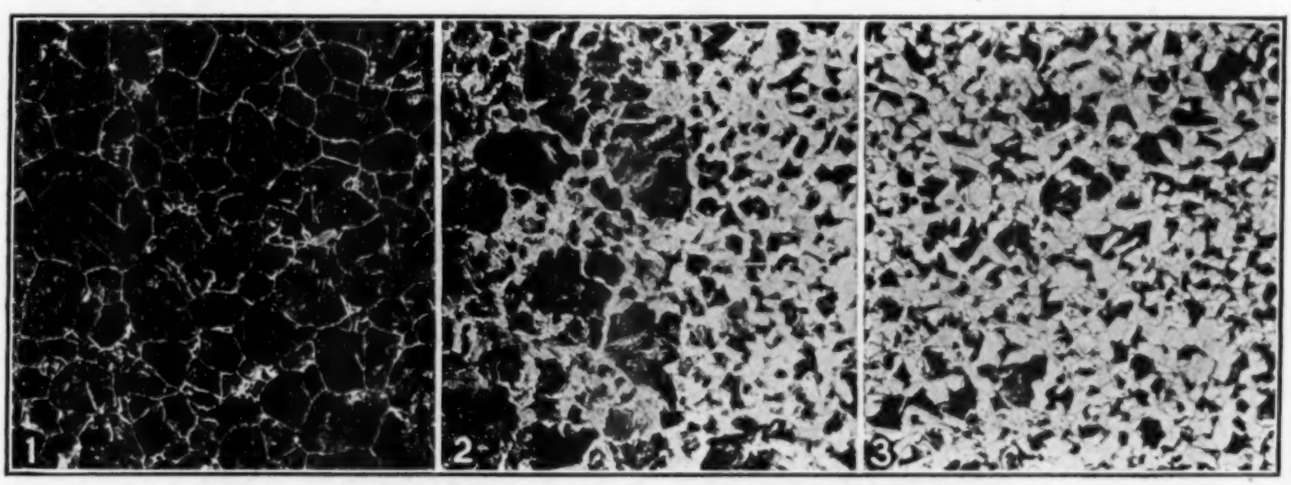
THE Packard Motor Car Company of Detroit has a slogan, "Only Packard Can Build a Packard." At first glance this expression may seem to be obvious but when it is remembered that the patent situation is such that many of the essential features can be and have been copied the thought may occur that there is more behind the statement than appears on the surface.

It is not because the company has devised many special machine tools. The tools it uses, with few exceptions, can be bought on the open market and are used by a number of other car manufacturers.

A partial answer to the question can perhaps be found in the fact that practically 35 per cent of the employees have been over 10 years with the company, and this large proportion cannot help but be an important leavening factor influencing the mass of workers. The standard of workmanship is high but this reason alone cannot furnish a complete answer.

Design is of course an important factor, but as has been stated, it can be largely copied. It is evident, therefore, that there must be a something in the organization that "makes good" the slogan. This spirit cannot be entirely abstract, but must make itself manifest in some tangible form and in fact is expressed largely in the standards set up for material, control and inspection. The important factor is that many years ago at the inception of the business high standards were set up, and have been consistently followed and improved. There is therefore a tradition of quality permeating every detail of work in the plant, and any work done outside of it as well.

An elaborate and fully detailed "book of standards" guides all work. At least twice a month, and usually oftener, the specification or Standards Committee meets and lays down rules not only for outside vendors to follow but also for the plant in its general operations. The personnel of this committee is worth noting. R. N.



Figs. 1 and 2—Desirable grain structure and size in hypereutectoid and hypoeutectoid zones.
Fig. 3—Desirable appearance of core microphotograph

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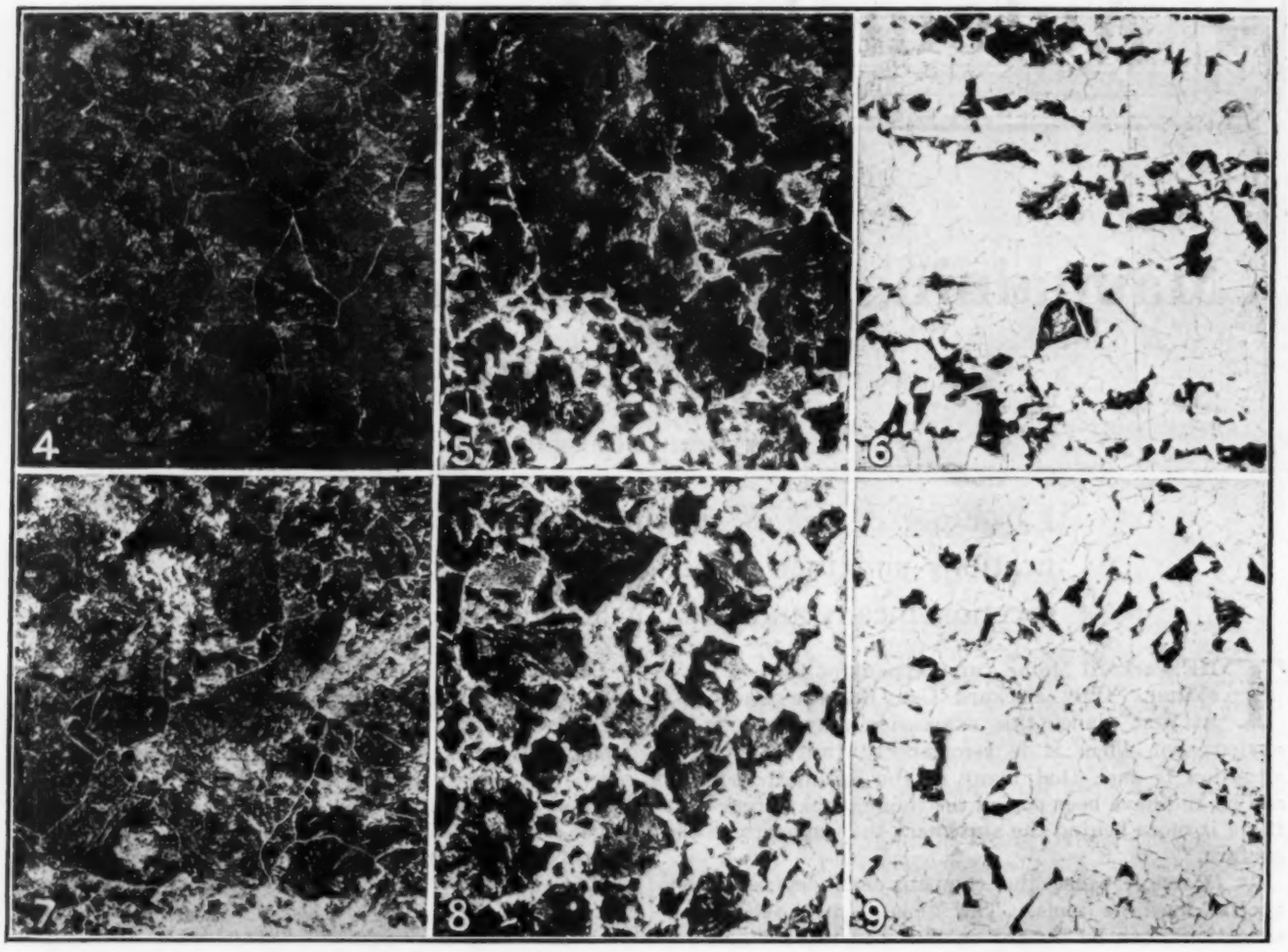
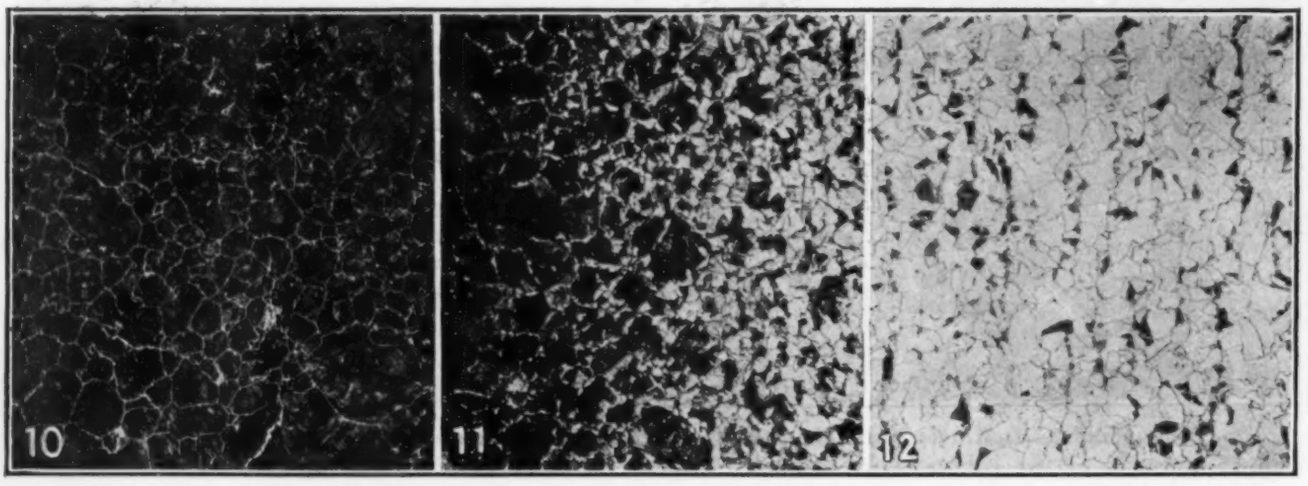


Figs. 4, 5 and 6—Maximum upper limit of grain size in hypereutectoid, hypoeutectoid and core zones, respectively. Figs. 7, 8 and 9—Undesirable modification in same zones by small grains

Brown, general superintendent, is chairman. R. R. Robinson, assistant purchasing manager; J. M. Haines, supervisor of stores; and W. H. Graves, metallurgical engineer, are members, and in addition Prof. A. E. White, Ann Arbor, attends as consulting metallurgist. The range of work covered is tremendous. At present cutting oil compounds are having their qualities investigated and when these are determined and approved they will be expressed in type. Glues, painting operations, steels, malleable iron, milling cutters, textile fabrics and so on—all come under the scrutiny of this committee.

For instance, all the steels purchased must be in accordance with very stringent specifications that are in agree-



Figs. 10, 11 and 12—Photomicrographs showing minimum acceptable grain size and structure in the three zones

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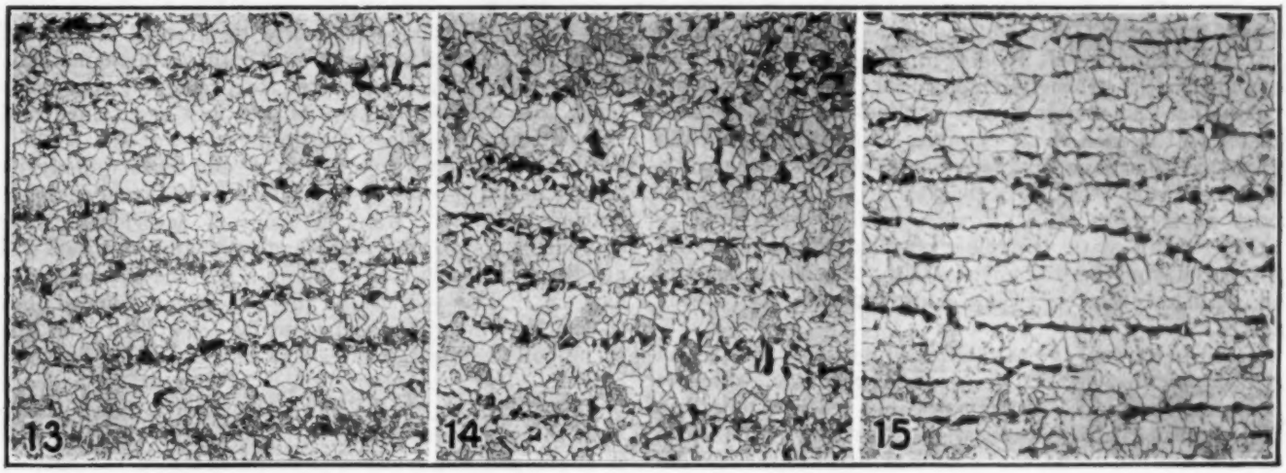

Fig. 13, 14 and 15—Photomicrographs showing banded structure

Fig. 16—Inspecting piston rings

ment with recognized standards covering chemical, physical and metallographic properties. The first specification deals with the general subject of forging steels, and the second covers the specific material requested. Both are used in the forging work of the company itself and also with outside vendors.

The vendor's statements of analysis are scrutinized and at least one sample is taken from each shipment as a check. A distinction is made between the quality or structure of the material and the physical dimensions. The metallurgical department is responsible for the former—the factory inspection for the latter. For example, a shipment of leather belts had been received and had passed the dimensional inspection. The metallurgical inspector filed on part of the protective enamel coating on a buckle and found the buckle material of steel instead of the specified brass. The shipment was rejected as absolutely no deviation from standard is permitted. This distinction of functions obtains throughout the factory. The men operating the Brinell and scleroscope instruments take their instructions on quality from the metallurgical department. They are responsible for discrepancies, routine and so forth to the foreman in whose department they are working.

A similar procedure is followed by the inspection department. The chief inspector is responsible for dimensional standards direct to E. F. Roberts, vice-president in charge of manufacture. The individual inspectors in the various departments answer for quality to the chief inspector but for discipline to the foreman. Inspection is rigid and all-embracing. As

Fig. 17—Checking up on connecting rods

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was instanced in the case of the leather buckle it reaches to every minute detail used in the plant. This fact cannot be too strongly emphasized. There are some parts that the company does not make. Take the ammeter on the dash as an example. Notwithstanding the fact that this gage has been passed as the output of a very reputable plant it is checked by the Packard company as if there were every probability of something being wrong with it. The physical dimensions are measured for correspondence with the blueprint and in addition the electrical characteristics thoroughly tested.

Each individual brake cable used on the cars is given a test pull to 2,500 lb. in a special machine, which is some six times what it may possibly reach in practice. This pulling test necessitated the construction of a special fixture. The company has many specially designed machines for inspection work. Fig. 16 shows, for example, a series of inspections on piston rings. Diameter, width, thickness, compression pressure and width of gap are measured very accurately in the special fixture.

A Surprise Check-up

In the shop itself inspection procedure is just as strict. In some places there is inspection at each operation. In others, such as connecting rods, Fig. 17, the inspection is done on the completed piece. There is always a supervising inspection and this often takes the shape of a surprise check-up. For example, a car may have been completed and awaiting its turn for shipment. A supervising inspector is taken by the fact that it is all finished, painted and upholstered and decides that he wants to see if it is as it purports to be. The car is withdrawn from the line and disassembled down to the smallest detail and each part is scrutinized carefully for any imperfection. Not only is this done with the mechanical parts of the chassis, but the upholstery and other body materials are also checked up. The percentage of trouble found is of course very small but the disciplinary effects are far reaching and tend to establish the meaning of the slogan with which this article started.

Machining the Open End of a Connecting Rod

By Philip F. Shafran

ONE of the solutions offered in answer to the problem, that of machining a 7x9-in. hole through a 4-in. piece of 0.50 carbon steel, illustrated on p. 328, Vol. 62 of the *American Machinist*, is as follows:

There are two methods in general practice of machining the rectangular openings for the bearing brasses in large steam-engine connecting rods with which I have had experience. One is to drill a row of holes, just within the layout line, and remove the interior part in the form of a solid block, then finish the sides of the opening in a slotting machine. The second method is to drill the four corner holes wtih a drill corresponding to the corner radius, and cutting a narrow slot from hole to hole, leaving a small amount of metal for the finishing cut. In both of these methods considerable time is required for removing the solid block, the drilling in that of the first mentioned and the slotting in the last consuming most of the time.

It is possible to remove the center more quickly by means of an oxyacetylene cutting torch, guided by a cutting machine. Manufacturers of acetylene-cutting equipment claim that a mechanically guided torch will cut through heavy steel, leaving a surface as clean as a saw cut. The surface of the cut is not burned, but it does pick up some carbon which, combined with the action of the heat, causes the surface to be slightly harder. The carbonizing effect is confined to a depth of approximately $\frac{1}{64}$ in., while the steel is hardened to a depth not greater than $\frac{1}{8}$ in. The increase in hardness is slight and will have little or no effect on the cutting tools if further machining is required.

Machining the Rod

The sequence of operations for machining the rod in question with this method is, first to drill four holes in the corners of the rectangular opening. A $1\frac{1}{2}$-in. high-speed drill should be used, run at a speed of about 250 r.p.m. with a feed of 0.016 in. per revolution. A jig should be used to guide the drill, while the other end of the rod is supported at a level with the end being machined. The support should be on rollers, or casters, to facilitate handling. The jig for drilling the holes should be of simple construction with four hardened bushings, properly located. Fifteen minutes should be a reasonable time allowance for setting up and drilling the holes, this being the floor to floor time.

The rod is then set up for the acetylene cutting operation. The cutting speed of an oxyacetylene torch for steel 4 in. in thickness is 7 in. per minute. The actual cutting time on this job would be between four and five minutes, while the setting up and cutting time should take approximately twenty minutes. The kerf, or width of the cut, would be about $\frac{1}{4}$ in., and the machine should be set so as to leave about $\frac{1}{32}$ in. for finishing. Before starting the acetylene cutting, the holes should be filled with fireclay to protect the finished radius from the effect of the heat.

Completed in One Setting

The final operation is accomplished on a slotting machine. The work is placed on parallel bars to provide clearance for the cutting tools. The tool head can be fed longitudinally for machining the two long sides, while the shorter sides can be finished by the use of the lateral feed of the table. In this way the rod is machined at one setting, the tool being reset for the different sides. The tools should be run at a speed of about 75 cutting strokes per minute and a feed of $\frac{1}{32}$ in. per stroke. The estimated floor to floor time would be about 25 minutes. The heavy end of the rod should be supported as in the drilling operation.

The total estimated time for producing the rectangular opening would be about one hour. With an average labor cost of 80 cents per hour and a cost of about 60 cents per rod for the gas consumption of the acetylene torch, the cost of machining the opening would be approximately $1.40 per rod, omitting the overhead.

Repair of Machine Equipment

By H. Ellsworth

Problems that confront the repair man—Diagnosing and curing the ills of machine tools—Deciding whether to call the doctor or the undertaker

AN OLD machine may mean one of ancient build either badly worn or but little used. Or it may mean a machine of fairly recent design, but badly worn. Some ancient machines have been so carefully preserved that it is not a question of wear, but of their non-productivity.

The equipment in most shops calls for the attention of the repair man frequently, but when a serious smash comes, or a case of general debility shows up, the big boss must be appealed to for permission to have the machine moved bodily into the repair shop.

A good and well-tried-out preliminary, is a printed form to be filled out with the estimated labor costs including hauling, riggers, electrical, millwright and pipe work, machining and fitting, together with cost of new material or new repair parts. From all of these estimated costs the scrap value of the rejected parts should be deducted.

This concise arrangement of estimates gives the chief and his assistants a comprehensive idea as to what is required, and they then can determine whether to rebuild, to sell, or to scrap the machine. If rebuilding is decided upon, the estimate form is given a number and becomes a full-fledged shop order, and a careful check-up of subsequent charges enables one to figure more closely in later estimates.

It is not an easy matter to make an estimate of rebuilding a worn machine. There is much that is concealed from view and it requires good judgment on the part of the "doctor" to know just what to do in the way of replacing and refitting spindles, bearings, shafts, screws, nuts, sleeves, gears, cams, and so forth.

A proper tool record of shop machinery should be kept, giving the shop number, builder's name and serial number, date ordered, cost, date received, kind of tool, its size, data as to capacities, location in works and any further record such as each shop may require. When most well-designed and properly-built machines come to grief, it is generally through carelessness on the part of the operators. It takes a long term in service for good tools to show much wear if they are properly handled.

Among the careless things done to machine tools can be cited:

Failure to keep oil holes and channels free from chips, dust and grit.

Excessive feeds and speeds.

Poor selection of cutting-tool shapes and bad grinding of tools.

Too much oil around oiling places, gathering dust and grit so that a real lapping of surfaces takes place.

Hammering and beating up the beds and slides, causing peening and distortion, or breakage.

Improperly clamping work to carriage or table, causing spring and misfitting of slides or bearings, and permitting the entrance of grit.

Belts applied too tightly, causing undue friction and harm to bearings, shafts and pulleys.

Bent spindle noses and cutter arbors.

Starting up machines too quickly. This is extremely hard on motors and belts.

Nuts that should be kept tight allowed to loosen.

Running a drill through the work and into the table.

Hammering a drill socket or sleeve into the spindle bore, unduly wearing and marring both.

The above are but a few things that are done in the average shop; the "doctor" can tell you many others.

In building new machines as well as rebuilding old ones, it is well to remember a few very important things, namely:

Proper planing saves much scraping.

Proper oiling saves the ways.

The best oil cups and caps are none too good.

Proper selection of mating metals.

Care that center distances of gears are properly maintained.

Properly scraping cylindrical bearings is vital.

Gear and belt guards should not be lost or mislaid after being taken off during repairs, as they cost good money. If forgotten and not replaced, an accident may occur, resulting perhaps in much pain and further expense by way of compensation to the workman.

It is well worth considering how many ways a pair of properly made bevel gears may be wrongly fitted. The faults found are:

Too tight or too loose in mesh.

Out of square two ways.

Out of square and out of plane in a great variety of

MACHINE values as carried on the books of various shops differ greatly. In many shops a yearly depreciation is marked off, in others, none at all. But whatever the plan or system adopted, age counts against most machines whether they are worn out, or superseded by those of newer design. There are many tools of standard design that are used sufficiently to give plenty of work to that much berated, usually underpaid, but on the whole much appreciated and respected individual, the repair man, or "doctor."

combinations, all of which are calculated to destroy the teeth, if the condition is allowed to continue.

It is a very nice job to fit up a repaired machine and it is a good test for judging a fitter's skill to give him parts of a planer head, all correctly machined and have him scrape and fit it up. Most workmen can do fair jobs of turning, fewer of planing, but to do fitting well, it seems as though one must be a born fitter.

Machines to be most efficient should be carefully leveled and fastened to the floor, preferably on a good foundation.

Workmen can hardly be blamed for neglecting a machine if the owners place it in a dark corner under a leaky roof or floor, and perhaps near a furnace or a floor grinder, and with poor illumination day and night. If, in combination with these conditions, the man loves his pay better than his job, he is liable to contribute generously to the daily troubles of the repair man.

Metal Surgery

Now if the slogan that "Machine Tools are the Master Tools of Industry" is true, it cannot be denied that the equipment in the repair man's hospital should be of the best, and as varied as is necessary for the upkeep of the entire establishment.

It has been said that "Anyone can do a good job if he has the tools, but that a good mechanic can work the job through without tools." This may have a grain of truth in it, but who is going to stand by and wait for him to get it done?

I have called the repair man "doctor," for such he is and he is worthy of some degree, whether bestowed by a college or by common consent, for he is a man set apart to cure the ills of our patient friends, the machine tools. Not only does he dispense soothing oils for parched and howling joints in knuckles, elbows and fingers, but his artistry in splicing, bending and setting of arms, legs and jaws is only a part of his truly scientific metal surgery.

Not a Cure-All

The age-old question as to whether an old and worn machine should be repaired, sold to the second-hand man or scrapped, bobs up in every shop so persistently that a word on the subject by a man responsible for machinery in a big plant may not be amiss. Let this not be construed as offering an infallible cure-all, but rather as one way of diagnosing the trouble and applying the remedy. It has been wisely said: "The only reason for replacing an old machine with a new one, is because the new one will do better work and more of it with less trouble."

Tom Johnson Plays the Game

By John R. Godfrey

OLD MAN JOHNSON is coming to depend more and more on his son Tom to run the Johnson Motor Works. And while Tom is on the job the old man is just learning how to play; he never had much time as a boy.

So, when I dropped in the other day I was tickled to see the way Tom handled a rather delicate situation. 'Twas about a special machine that had broken down after about a year in service, and required extensive repairs. And the question was, who was to pay the bill.

Tom, and especially his engineer, Blakesly, felt that the builders should make good. But the builders were blest with a salesman who had a broad vision and who knew how to present his case. And as his side of the argument has a bearing on all special machinery it's worth listening to. The salesman told his story something like this:

"When it comes to the actual length of service, it's a toss up as to whether the machine is a year old or not. I think it's a bit over myself. But I'd rather not balk at a given date of a few days one way or the other. Isn't the main question really whether the machine was worth what you paid for it, or not? If it isn't then we are willing to make it a profitable investment for you. If it has been worth what you paid for it—and I'm inclined to believe it has—I know the Johnson Motor Works is too square a concern to quibble over the question of a few days, one way or the other.

Special Machines are Experiments

"A lot of people seem to forget that special machines cannot be considered in at all the same way as a standard product. A special machine is always more or less of an experiment in which the designer digs into his past experience, and adapts it to a new use, as best he can. When it comes to new combinations of cams, gears and levers, two and two don't always make four. Sometimes it's five and then again it may be only three and a half. If all designers were hundred-percenters, and got just the right proportions of frames and shafts and bearings, perhaps we could always tell in advance just how a new combination would work out. But we don't seem to be able to do so—always.

"When a man builds a special machine for himself he knows it's a bit different from standard practice. If it works perfectly he saves oodles of money. If it's a dud, he loses a lot.

"When he turns the order over to someone else, he insures against loss by specifying the minimum performance it must deliver. And this minimum insures him a profit. Everything above that is velvet.

Profit on the Savings

"We, of course, made a profit on the actual cost of the machine. But few builders of special machines ever get an adequate return on the engineering work and experience that goes into them. The only way they'll ever do that is to get a percentage of the savings the machine makes during a given period. But the buyer hasn't been educated up to that point as yet.

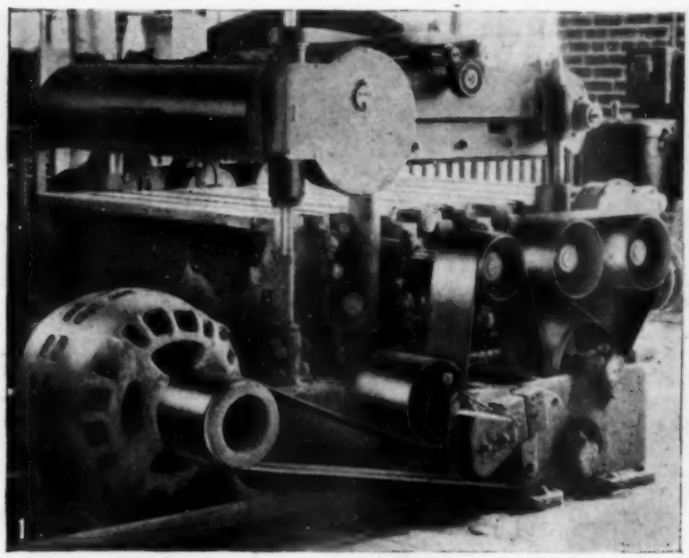
"Now if you feel that you haven't made a fair profit on the machine, then we can begin to argue about paying for the repairs or splitting the cost. But from what you told me of the savings during the eleven or twelve months it's been in service, I'm guessing that you can well afford to pay for the repairs. If we have to pay 'em—that cost has got to go into the next machine we build for you. It won't be labeled and you won't know it as such, but it will be there. It's got to be. Think it over."

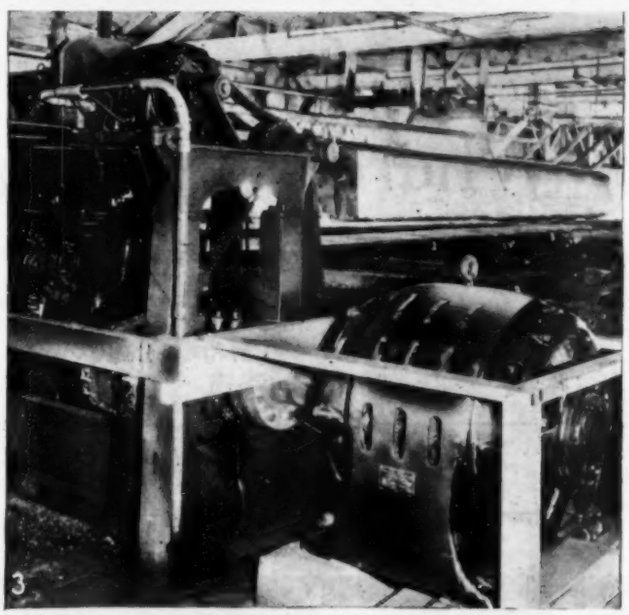
Tom and Blakesly looked at each other and grinned.

"I guess we'll pay it," said Tom. "The machine has paid for itself already."

So they were all happy.

If more disputes were brought out into the open and discussed frankly instead of hiding behind technicalities, there would be a better understanding in most cases. The average prefers to play fair.





Motorized Machines in Many Industries

1—30-hp. motor on drum sander

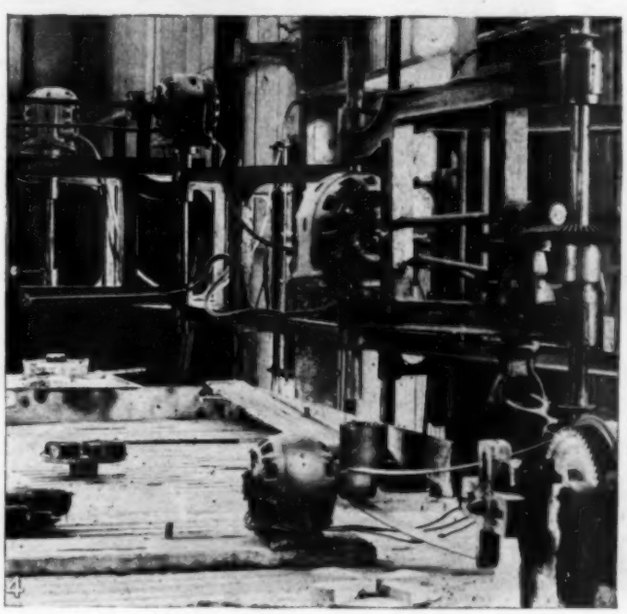
2—5-hp. ball-bearing motor on slate grinder —covered with slate dust

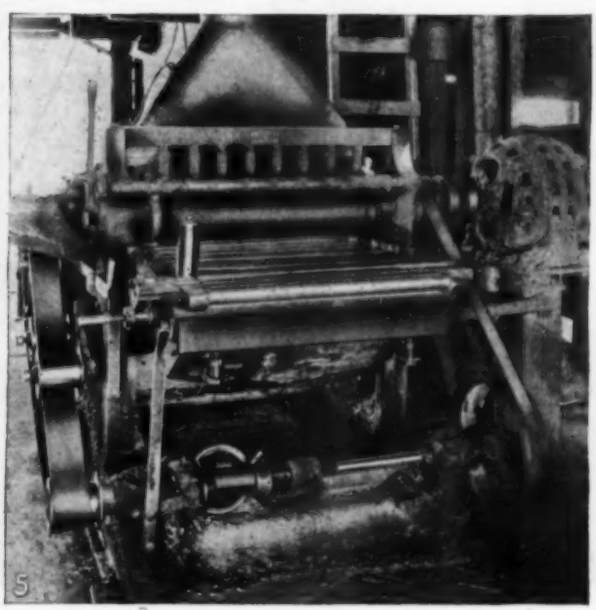
3—200-hp. ball-bearing motor on large lumber edger. 15-hp. variable-speed motor feed

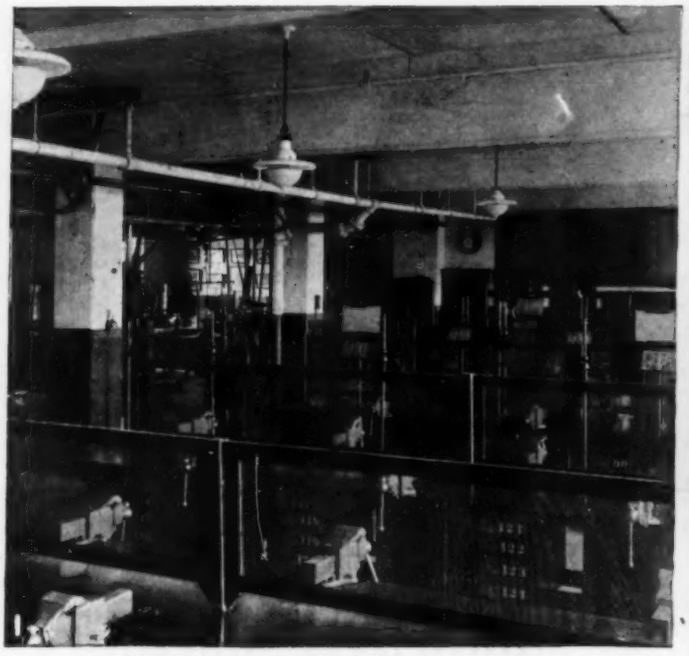
4—Three 3-hp. ball-bearing motors on marble polishing machine

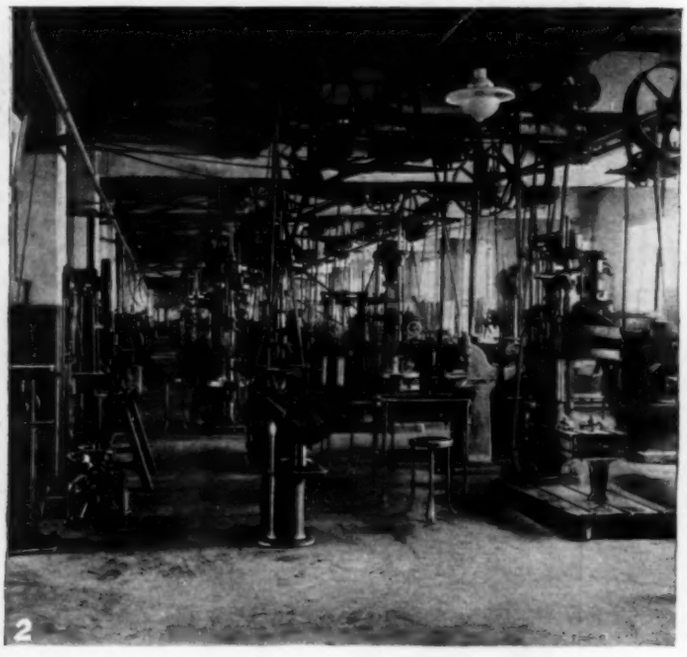
5—20-hp. ball-bearing motor on wood planer

Photographs by courtesy of Fairbanks, Morse & Co.









Where Boys Learn

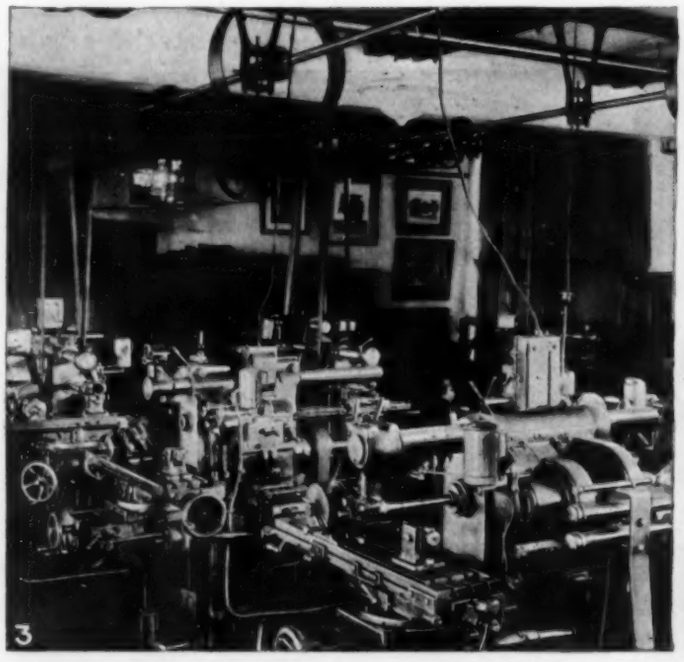
The Machine Tool Laboratory of the Massachusetts Institute of Technolgy occupies 60x350 ft. and contains about 180 machine tools, most of them new enough to be called modern. In addition there is the usual equipment of power hacksaws, arbor presses, welding machines, etc. There are two toolrooms equipped with the machines usually found in these departments in modern shops. With the equipment furnished, the boys are enabled to get practice on practically all types of machines.

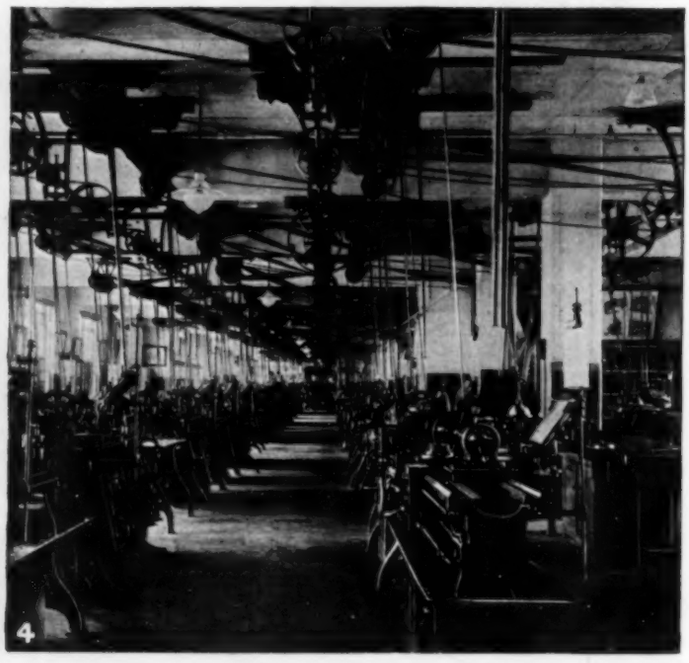
1—Where bench work is taught

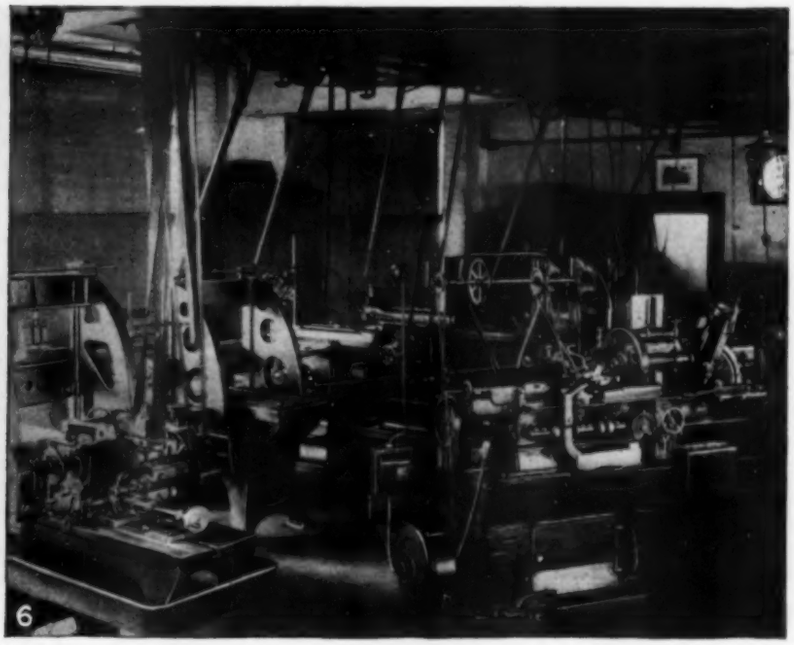
2—Some of the drilling machines

3—A group of milling machines

4—Part of the 55 engine lathes







Practical Shop Work

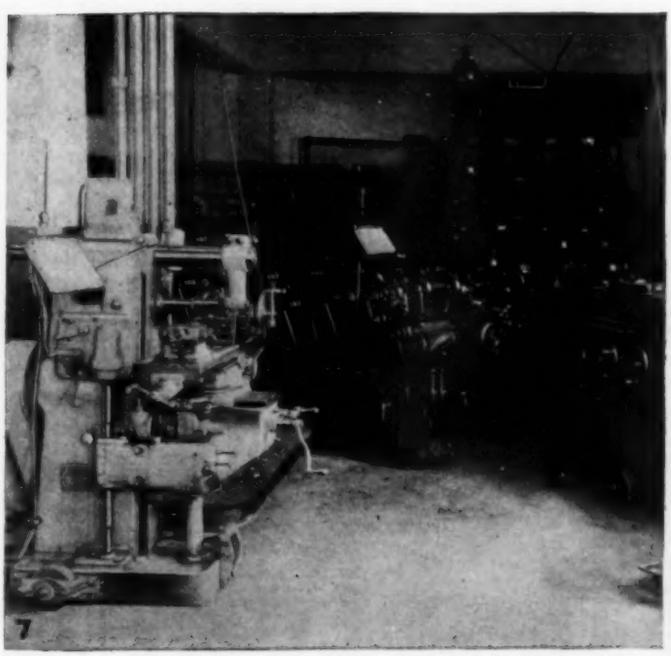
5—The grinding machine corner

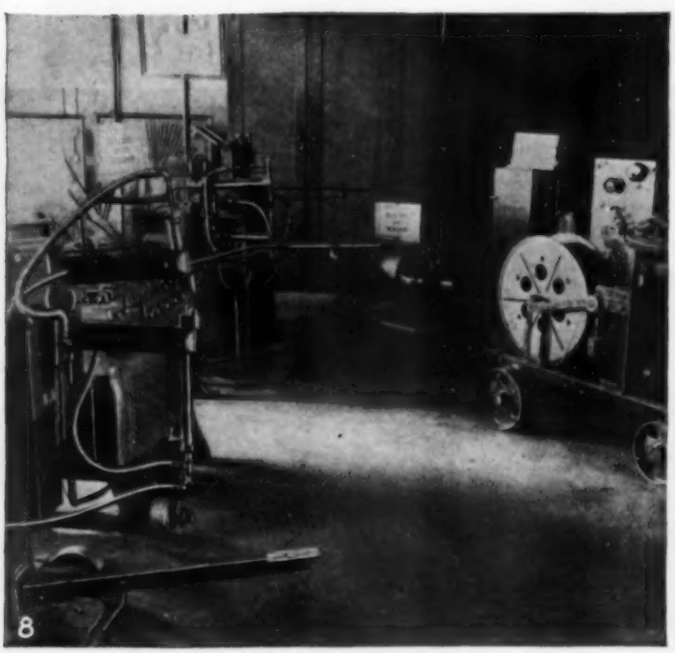
6—Planers, shapers, gear cutter and automatic screw machine

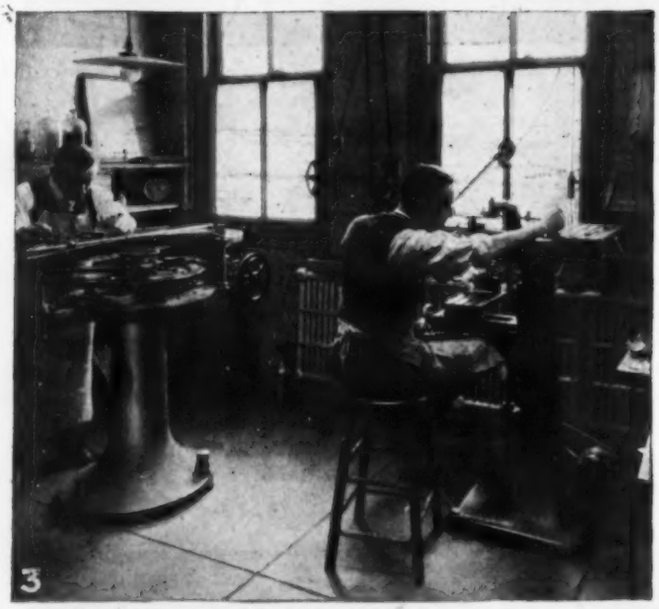
7—Portable tools in lecture room

8—Electric welding equipment

Lectures are given in an amphitheatre seating 100 students. One machine of each type is mounted on wheels so that it can readily be moved into the lecture room and operated before the class as in No. 7. Among the equipment are 55 engine lathes, 20 speed lathes, 9 cylindrical grinders, 12 universal milling machines, 5 planers, 5 shapers, etc. A precision measuring machine, scleroscope, lead test indicator, comparator and other instruments are also used.







Making Flying Safer

1—The drafting room

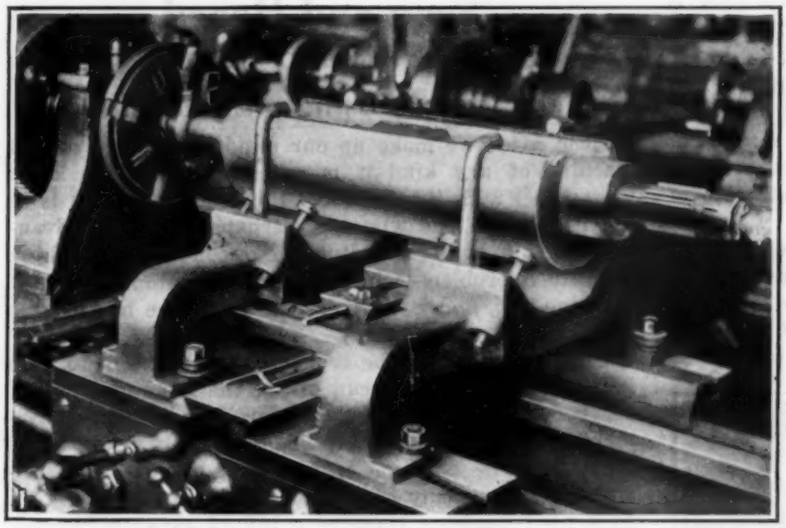
2—Laboratory where the "Earth Inductor Compass" was developed

3—Engraving machine room—separate from the main building

4—Making the "wobble" auxiliary-fuel pump

5—Precision-lathe department

Photographs by courtesy of the Pioneer Instrument Co., Brooklyn, N. Y.



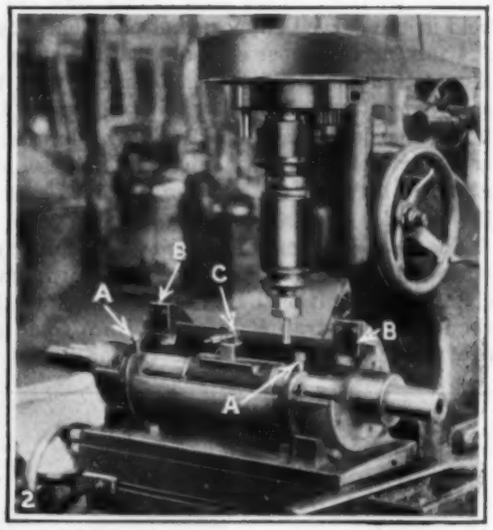


Fig. 1—Boring the printing cylinder. Fig. 2—Milling the central slot

Cylinders for Printing Presses

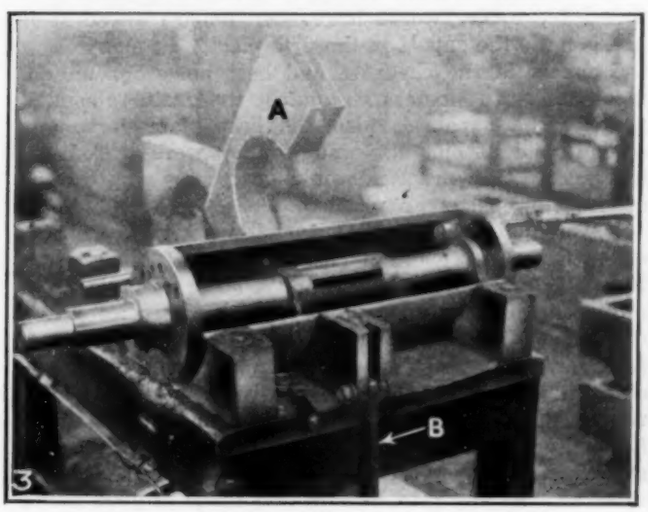
By Fred H. Colvin
Editor, *American Machinist*

Some of the methods and fixtures used in machining and assembling cylinders for small printing presses — Inspection gages for hole location

THE cylinders that carry the paper in printing presses have to be very accurately machined in order to secure an even impression as the type form passes beneath the cylinder. Some of the operations in the machining and assembling of such a cylinder in the plant of the Kelly Press Division of the American Type Founders Co., Elizabeth, N. J., are illustrated herewith.

One of the first operations is to bore the cylinder for the supporting shaft, a special cradle being used on an engine-lathe carriage for this purpose, as in Fig. 1. This illustration shows just how the cylinder is positioned and supported by eight large-headed screws, each head being provided with holes for a pin wrench so as to secure easy adjustment for any slight variation in the casting. The cylinder is held down on the supporting screws by means of four hook bolts. As shown, the reamer has just finished the bore in the outer end of the cylinder.

After a few drilling operations, the cylinder with its shaft in place goes to the Becker vertical milling machine shown in Fig. 2, where the slot is milled in the



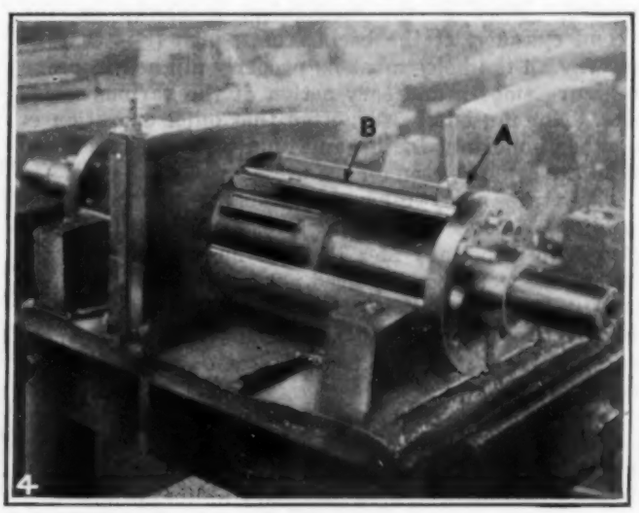


Fig. 3—Final reaming of holes. Fig. 4—Testing alignment of holes

central portion. This view shows how the cylinder is held in the curved support and positioned by the screws *AA* forcing the upper edge against the stops *BB*. In the illustration the slot has just been cut with the end mill and its location is being tested by the gage *C*. This gage fits in the slot, being held firmly by a knurled screw that is barely visible, and the micrometer screw measures the distance between the edge of the slot and the face of the cylinder opening.

The cylinder then goes to the assembling department, where it is held in the wooden form shown, being clamped in position by the upper block *A* by means of the swinging strap *B*, Fig. 3. Here some of the holes are reamed to finished size, the alignment tested and

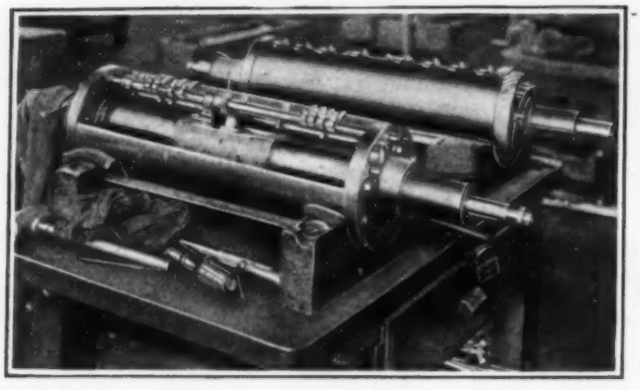


Fig. 5—Assembling the paper gripping mechanism

a few final tapping operations performed. Then begins the assembling, as shown in Fig. 4, which also indicates how the clamps hold the cylinder in position. The holes are inspected both for diameter and location, some of the gages being shown. The block *A* in connection with the test bar *B*, shows whether the holes carrying the rod *B* are properly spaced with relation to the upper edge of the cylinder. This block has go and no-go surfaces, and tests the spacing of the bar at each end.

Some idea of the mechanism that goes in these cylinders may be had from Fig. 5. The bevel gears in the center are operated by a rack that is given an end movement at the proper time, by a rod passing through the hollow shaft on which the cylinder runs. This rod rotates the bevel gears and operates the fingers that alternately grip and release the sheet of paper being printed. More of the mechanism is shown on the second cylinder, at the back, from which it is easy to see why all the holes must be properly aligned in order to secure smooth and easy action of the various members. Nor must it be forgotten that quiet operation is a rather important factor, and requires proper meshing of all the gearing used on the press.

There are many other problems in the successful building of modern printing presses, but this shows enough to dispel any idea that the mechanism is crude or that the workmanship need not be accurate. A careful study of the articles that have appeared showing the practice in this shop must show that good workmanship is as essential, as in any other high class machinery.

It was Elbert Hubbard, who went down on the Lusitania, who said that "we are apt to be down on the things we are not up on." We frequently fail to appreciate the careful designing necessary in lines of machine building with which we are not familiar.

Seen and Heard

By John R. Godfrey

The cost of using old machines

Even after we make up our minds to discard an old machine of any kind it is quite a problem to know what to do with it. Probably the first inclination is to sell it to serve one who can, perhaps, use it to advantage in his business. But the second-hand machine is quite a problem, whether it is an automobile or a machine tool, and it isn't easy to know the best course to take.

On the face of it, the economic procedure is to pass it on to some one who can utilize the remaining miles, or production, at a profit. For practically every automobile or machine has more life than we have extracted from it. The question is to get it out *at a profit*—and there are many cases where the apparent bargain in a used machine becomes a bill of expense instead.

It seems like finding money to buy a car that cost $5,000 for $500 or even less, especially since there is no question as to its having many more miles left in most of its parts. Taxicabs run up 300,000 miles or more, but the private car is a different story. But the automobile has not reached the stage of the deacon's "one-hoss-shay"—and we find that a new steering pin or differential pinion, or other part needs replacing soon after we get it. The cost of the part isn't very high perhaps, but by the time it gets into the car it has run up a nice little bill.

Large manufacturers with several plants, or several departments of one plant, have devised the plan of having a used machine department where discarded machines go for re-distribution. The foreman who wants additional equipment for his department looks the machines over and, if he thinks he can use a certain one to advantage, it is transferred to him and charged at a used machine price. This plan has many advantages and where the foreman really asks for a machine it is apt to work out well for all concerned.

In one case I know of, however, a large machine seemed too good to melt up or sell for scrap, so it was sent to another plant with the idea of it being used there. After about five years it was still found kicking around from plant to plant without having been put to use. Some bright chap figured up the cost of shipment, storage and the interest on its scrap value and found the owner would have been dollars ahead if it had gone to the cupola in the first place. In many cases the cupola is the cheapest and best place for an old machine even if it does go against the grain to send it there. The cupola is also the best place for many second-hand automobiles and if they were broken up and melted, the practice would go a long way toward solving the used car problem.

Unfortunately few of us are either in the position, or have the nerve of an old contractor I knew of in New England. He was building a large concrete dock, piling and filling as he went along. He used a number of the old Westinghouse single-acting steam engines for running his stone crushers, running them night and day till they wore out. Then without attempting to repair them he quietly dropped them overboard as filling and swung a new one into place—keeping several spares always on hand. Perhaps this was cheapest after all. At any rate, he said they made as good filling as anything else.

Typical Turret-Lathe Tooling

Special Correspondence

Some of the standard Jones & Lamson tools that enable turret lathes to be quickly set up to handle a large variety of work

SOME of the methods that have enabled the modern turret lathe to be used economically in producing small quantities, are illustrated herewith. Quite a variety of jobs have been selected to show the adaptability of standard tools in competing with the methods formerly considered necessary where only a few pieces were required.

In the machine illustrated, the cross-sliding travel is secured by moving the head across the lathe bed. In addition, some of the standard tools have a cross movement used in forming and cutting off, as in Figs. 2 and 5. While stops have to be set for each tool and the rolls must be set in the roller turning tools, this is offset by eliminating the necessity for centering and spotting for steadyrests, where heavy cuts are to be taken. The time taken in adjusting the roller turning-tools is more than made up by the time saved in taking cuts, as in Fig. 1, where a 2-in. bar of machine steel is being reduced to 1 in. with a satisfactory finish. And these same tools can be used on a large variety of work.

The tool layout for a comparatively simple bar job is shown in Fig. 2. This is an eccentric stud, the offset being secured by rotating the work holder 180 deg. in the chuck. The tool layout is almost self-explanatory and shows the use of cross-slide tools, in positions 3 and 6. The first chamfers the head and faces the shoulder, while the second finishes the shoulder and cuts the piece off the bar. The eccentric diameter is turned in the second position, after which the eccentric bushing is rotated to the concentric position. The time on this piece is 2¼ minutes.

A striking example of the way in which the same tools can be used on widely varying work is seen in Figs. 3 and 4. In Fig. 3 is a long bar having four different diameters, while the piece shown in Fig. 4 is a short, threaded cap. In spite of this difference, the only difference in the tooling set-up is in the number of roller tools used.

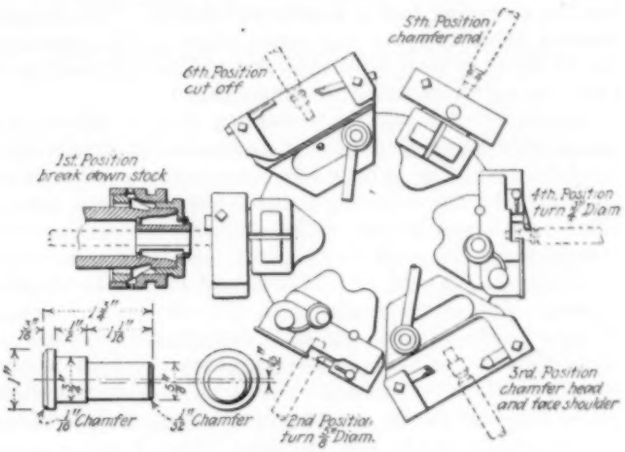

5th Position chamfer end
6th Position cut off
1st Position break down stock
4th Position turn ⅞" Diam
3rd Position chamfer head and face shoulder
2nd Position turn ⅞" Diam.
1/16" Chamfer
1/32" Chamfer

Fig. 2—Turning an eccentric stud

Another good example of the bar work is shown in Fig. 5, the depth of the hole being somewhat unusual and making it desirable to divide the drilling into two operations. In the first position the counterbore is drilled, thus reducing the depth to be drilled for the smaller hole by 1¼ in. Here again the cutting off is done by a cross-sliding tool in the sixth position. The fifth position carries a roller back-rest tool that is ground to chamfer and also to face the end to length. The time for this job is 7¼ minutes.

In Fig. 6 is a somewhat unusual tool set-up on a machine with a square turret, which is so designed that each of the four corners can be used for supporting tools if desired, as indicated by the corner toolblocks shown. In addition, the tools can be fastened to each side of the toolblock, carrying a bar or other cutting tool so that a number of cuts can be taken at the same time.

The use of the thread chasing tool is shown in Fig. 7, the correct lead being secured through the overhead apline shaft shown. The method of holding and adjust-

This is the second article under the title given above. The first was published on page 373, Vol. 62.

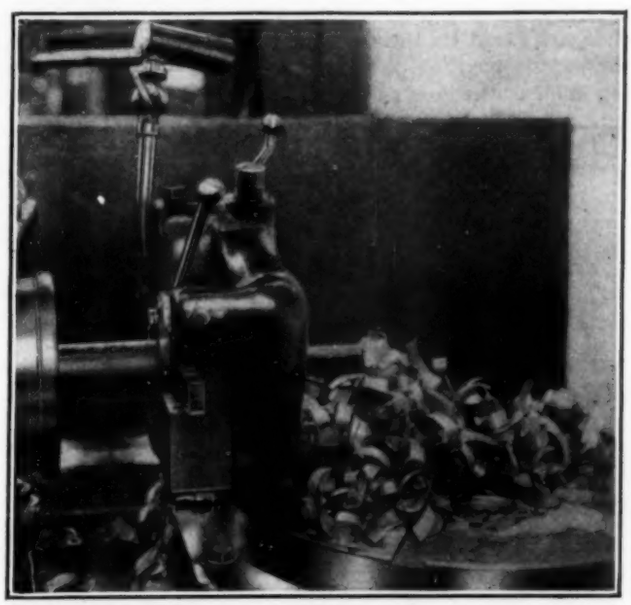


Fig. 1—Heavy cutting in roller rest

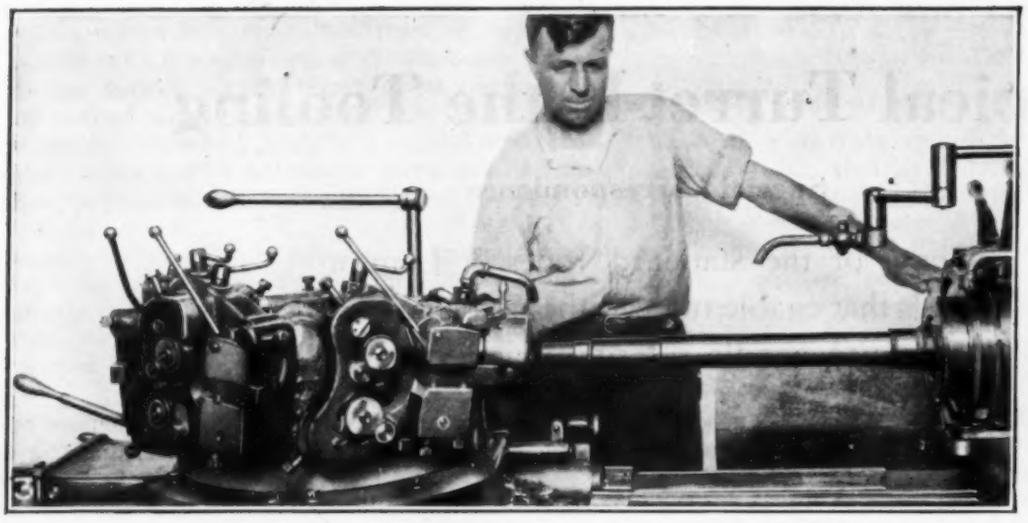


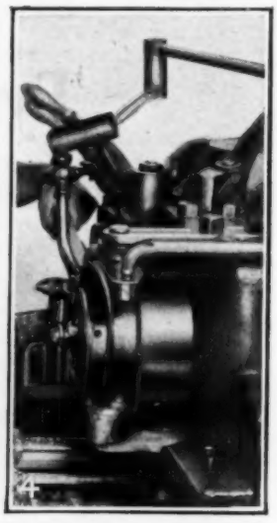
Fig. 3—Five diameters on a long bar. 

Fig. 4—Short screw caps with similar tooling

ing the recessing tool *A* is also of interest. The thread chasing attachment is automatic, since all the operator has to do is to feed the head over a slight amount each time the cutter returns for a new cut.

Another tool layout is shown in Fig. 8, where the pump body being machined is shown in the upper left-hand corner. The proper spacing of the two chambers is secured by the indexing fixture shown and the operations performed in the different turret positions are indicated by the outline. There is also shown a somewhat unusual layout of the tool-holding blocks on the turret. Machining in this way, the two shaft-bearing holes are held parallel and to a definite center distance within 0.001 in., and the gear pockets are held to the specified diameter within 0.0015 in. The handling of both operations at one chucking of the piece enables the time to be cut to 14½ minutes.

In Fig. 9 is a very large piece with several operations. The main point of interest is the boring of the center hole in the first position. The tools divide the 4-in. diameter cuts between them, the first starting its cut half way through the hole by being fed to the proper depth by means of the cross-sliding head. The head is then locked in position and the longitudinal feed thrown in. The third tool is so positioned that at the same time the two tools are rough boring the 4-in. diameter, the

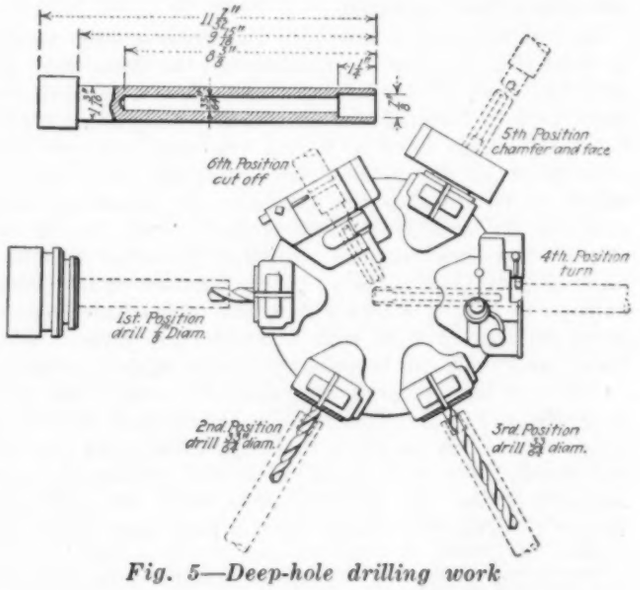


Fig. 5—Deep-hole drilling work

first tool is rough boring the 4¾-in. recess. The inner ends are faced by the cross movement with the tools in the second position, a recess being cut for the threading tool at the same time.

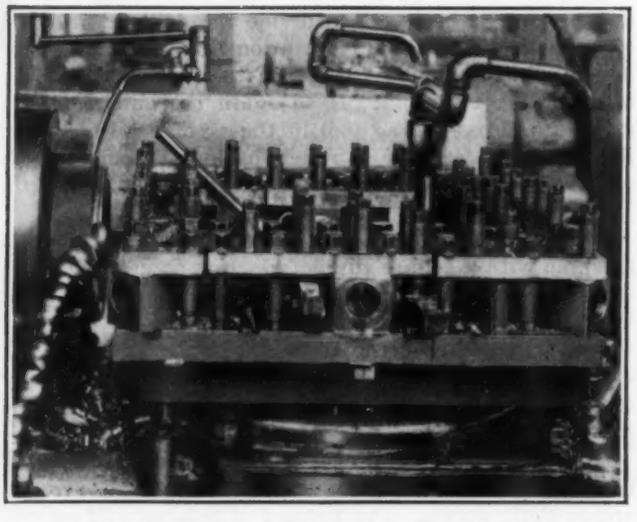


Fig. 6—Using corners of square turrets

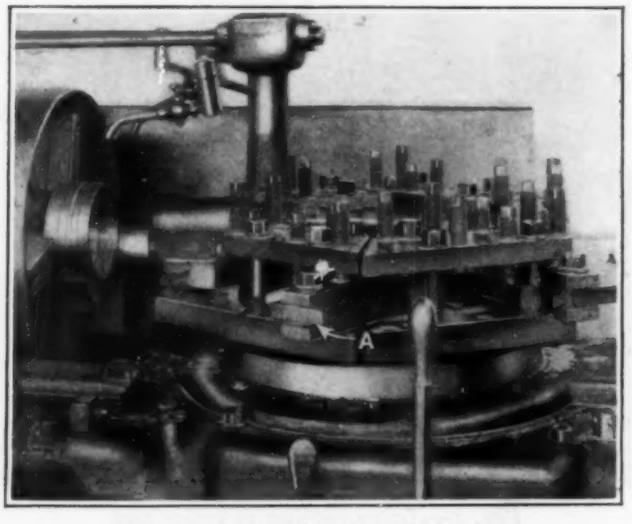


Fig. 7—Automatic thread chasing

Finish boring the thread diameter is done in the third position, while position four finishes the bore, also with two cutters in the bar, and chamfers the recess shown. The thread is chased by the automatic tool in the fifth position, the final operation being to ream the 4-in. bore as shown. This is held to a thousandth limit, plus or minus, and the total time is 10¼ minutes.

Standard tools are also provided for taper turning, as shown in Fig. 10, where a rocker pin is being machined from a forging. The taper turning tool is shown in the fourth position.

With the examples illustrated herewith, and also those that have been shown in previous issues, there should be little hesitancy on the part of shop managers or production men, as to the possibilities of using turret lathes of various types on parts built in rather small quantities. The tools that can now be secured as standard equipment can be utilized on such a wide variety of work as to make a special tool-holding device almost unnecessary on the average work.

The tools and stops, of course, require special settings to suit the diameter and lengths of cut. But standard cutting tools can be kept in stock, sharpened ready for use, and set up on very short notice. One of the main requirements is a man with experience and ingenuity enough to grasp the needs of each job as it comes along.

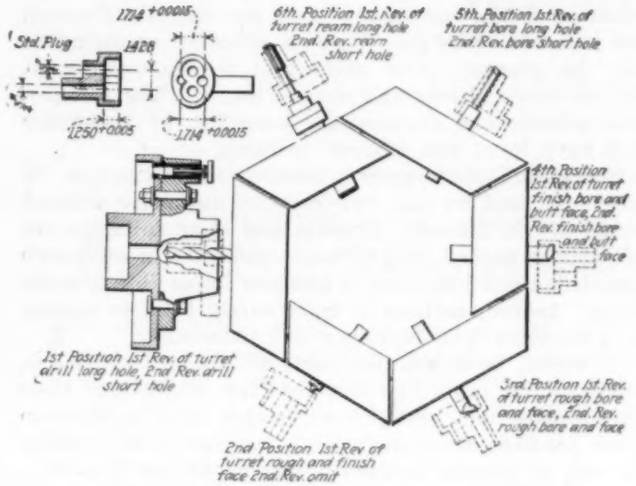

1.1714 +.0001 -.0015
Std. Plug
1.1426
1.1250 +.0005 -.0005
1.1714 +.0001 -.0015
6th. Position 1st. Rev. of turret ream long hole 2nd. Rev. ream short hole
5th. Position 1st Rev. of turret bore long hole 2nd. Rev. bore short hole
4th. Position 1st Rev. of turret finish bore and butt face, 2nd. Rev. finish bore and butt face
1st Position 1st Rev. of turret drill long hole, 2nd Rev. drill short hole
3rd. Position 1st Rev. of turret rough bore and face, 2nd. Rev. rough bore and face
2nd Position 1st Rev. of turret rough and finish face 2nd Rev. omit

Fig. 8—Machining a pump body

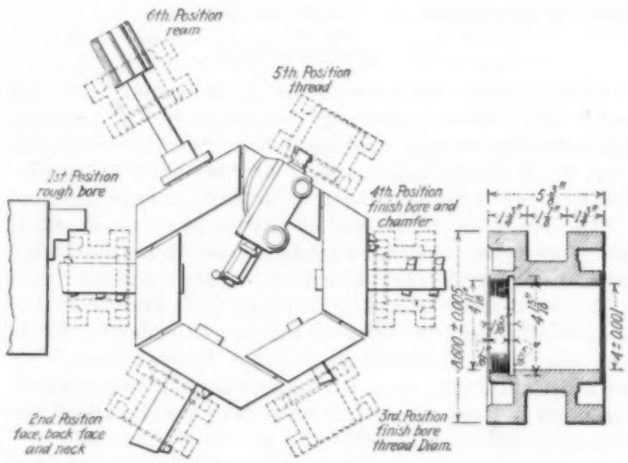


Fig. 9—Double-tool boring

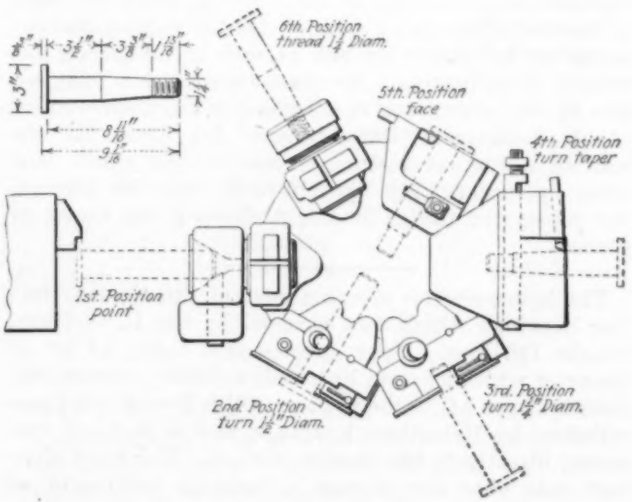


Fig. 10—Turning taper pins

Hookworm Draftsmen—Discussion

By W. Roland Needham
Essex, England

I read the article under the title given above, by John F. Hardecker, and published on page 579, Vol. 62, of the *American Machinist*.

Such men as Mr. Hardecker had in mind are draftsmen in name only. A bona fide draftsman is an engineer in the best sense of the term. If ways and means are not in his line; if he instinctively shirks problems and always desires to travel in a well-beaten track, it is not only the work he does that is hackneyed; he is himself just a hack. In other walks of life, a temperament of this kind may be tolerated, but not in an engineering career. At best, even should be have been placed in his position through influence, such a man will be but a glorified copyist.

No one who has a genuine love for engineering is really of this order. Many, however, drift into something resembling it through natural indolence. The desiderates for a draftsman are, that a man train himself into habits of observation, reflection and deduction. He needs to win a good working grip on first principles; to develop his bump of curiosity (it is vital that he should find out things for himself); and he must banish fear. It is for many draftsmen mostly a matter of psychology. They funk the unusual. It is, however, just the unusual that gives many the opportunity to make good. There must be, of course, a certain groundwork upon which to build securely. Given this, it is well not to accept discouragement.

Something needs devising in order to secure a definite result. The hack, or hookworm (to quote Mr. Hardecker) is all at sea, but the engineer refuses to be flustered, and calmly weighs matters. He has something of the spirit of adventure striving within him—the lure of the quest grips him. Things worth doing are done by men of the latter type, but never by the former.

Of course, the hookworm may simply be a fish out of water. He may be an admirable salesman, or artist, or anything under the sun but a draftsman. If this be the case, he certainly should in his own best interest quit the design side of engineering.

Being a Successful Foreman—Discussion

By E. Andrews
Manchester, England

I read with interest the abstract under the title given above, published on page 441, Vol. 62 of the *American Machinist*, and am heartily in accord with the views therein expressed. They are timely and to the point. From my own observation and experience I know that the prime requisite of a modern foreman is to understand human nature and to be able to direct men—a very different sort of a task from operating machines, manipulating tools and handling material. The foreman who possesses an understanding of the habits, temperaments and adaptabilities of his men, is able to fire their enthusiasm and raise them out of their old habits into line with his plans.

Ability Must Be Developed

Good foremen are not like mushrooms, that grow overnight. They must be developed. A successful foreman must have personality, must be a judge of character, and must be able to lead and control men. In order to do these things he must be able to get the other fellow's point of view. He must be experienced in the line of work that is conducted under his supervision, he must be able to organize both work and men, and he must have a good working knowledge of costs and how to compute them. What sort of training, therefore, should a prospective foreman receive?

The writer believes that it is best to select candidates for foremen from among those workers who possess the qualities of leadership and imagination, and to make the selection at an early age. The other qualities necessary to success can be imparted by training.

This is a very different basis of selection from that in vogue not so long ago, when foremen were chosen "merely because of their reputation as the best workmen of a group." When such a qualification is made the basis of selection, it is almost a foregone conclusion that a candidate should have had little, if any, training and experience in supervising other workers, and it not infrequently happens that in this way a first-class worker is lost to industry in order to secure a third-rate foreman.

The Psychology of Teaching

The fallacy of this method lies in failing to appreciate the mental qualifications required of a foreman, as opposed to those of a worker. The latter has only to carry out a process; the former must teach, encourage and assist those who work under his direction, must control his men and be able to organize the work itself.

In this connection the whole psychology of learning and teaching is involved. In many large industrial plants attempts are now being made to devise intelligence tests that can be applied to young mechanics in order to determine which ones may be potential foremen. Such tests are usually based upon the mental make-up of successful foremen, and may be expected to reveal the qualities that tend to success.

The idea of training young men for foremanship seems to have come too late to undo some of the evil effects of our present apprenticeship systems. Training in industry is not synonymous with education. The qualities of the leader are social rather than industrial, and they need support during the education of the youth. If education fails to disclose these qualifications, industry declares the canditate to be lacking in them, whereas he may have lacked merely the opportunity to develop them.

The future prosperity of the engineering industries depends to a great extent upon the way its foremen are trained. Whatever form of scientific organization may be adopted, it is plain that the foreman must become less a driver and more a leader. The foremen who possess and exercise the essentials of leadership will have loyal and efficient workers.

Successful foremanship requires the exercise of authority, and no man can exercise authority without confidence in himself. Prompt and clear decisions are oftentimes needed, and without confidence in one's own knowledge and judgment it becomes impossible to make them. Indeed, nothing is more surely fatal to success as a foreman than hesitancy and indecision.

It would, no doubt, pay many of the larger firms in industry to organize schemes for educating their apprentices and younger mechanics with a view to their possible development into foremen, and it might be well to include in such a scheme the services of a trained industrial psychologist; for it should be obvious that the attempt to exercise authority by those who are mentally or temperamentally unfitted, is one of the most prolific causes of friction in industry.

Art and Profession

Foremanship is not a vocation; it is an art. The fact must be recognized that successful foremanship demands the specific qualifications above indicated, but that much study and training are required to supplement it—as is true in the case of any other profession.

Unfortunately there still remain a few employers of the older type, with their crude rule-of-thumb methods, who resent a change, who hate inquiry and analysis, and who despise scientific methods, yet wonder at the abnormally high cost of production. In order to obtain and maintain productive efficiency in manufacturing, we must eliminate all of the square pegs in round holes; we must get out of the rut that is beaten hard by the footsteps of our forefathers.

In conclusion, it should be emphasized that the foreman in industry cannot afford to neglect details. He must know his business from A to Z. He must put in a great deal of solid spade work, and he must also learn to use the telescope as well as the microscope, thereby acquiring a broader outlook as well as a capacity for minute investigation. He must exercise his imagination in the search for new ideas for the improvement of his department, lest he spend his days, like the man in a famous picture, grovelling for small coin, when by modernizing himself to fit into the present-day scheme of things he might discover the crown of success.

The hydro-electric steering gear of the airplane carrier Saratoga which was accepted by the U. S. Navy, weighs 110 tons. Four double-ended rams, 24 in. in diameter which move in hydraulic cylinders operate two links that run aft to the rudder. Oil is forced into these cylinders by Hele-Shaw hydraulic pumps that are connected directly to the electric motors. The tests show that this gear can deliver a twisting movement of 70,000,000 in.-lb. to the rudder post.

Fabrication of Materials in Machine Shops

By Joseph Kaye Wood
Consulting Engineer, New York City

Forming and sizing of component parts—Their influence on machine design—Relative movements of work and tools—Contour angles of the tools—Recommendations for best results

IN MODERN machine shop practice raw materials are fed systematically into stock at a rate sufficient to maintain a safe surplus, or minimum stock as it is called, above the quantity being drawn out for regular production. This surplus is maintained because of production surges which are bound to occur.

Just how large the minimum stock should be will depend upon the extent to which the rate of production is apt to vary throughout the year and on the type of article being manufactured. It should be controlled in accordance with sound economic principles as regards market fluctuation and "tie-up" in idle capital.

Fabrication of the raw materials going into production consists of two general operations so far as the machine shop is concerned. These are forming and sizing of component parts on the one hand and assembling of the parts on the other. The following discussion is confined to the sizing and forming of raw materials, forgings and castings being considered as such from the machine shop's viewpoint.

The method which can be taken as correct for the work depends upon the following general factors:

The nature of the raw material.

The type of contour.

The accuracy required in sizing.

The production rate as governed by permissible maximum cost and labor conditions.

By giving the proper weight to each of these factors a suitable method of production is decided upon which may be made up of any one of or several machining and forming operations. Machining or cutting operations from a broad viewpoint consists of the following:

Punching
Shearing
Planing and turning
Milling and sawing
Shaping and slotting
Drilling and boring
Reaming
Broaching
Grinding
Scraping and filing
Lapping
Polishing

It is questionable whether lapping and polishing, used relatively little in ordinary commercial production, are really cutting operations. If "cutting" is taken to mean an actual breaking of atomic bonds, even though they be few in number, it might be correct only to consider lapping and polishing as cutting operations in part, the remainder of the process in each case being a forming operation. Forming is the operation of deforming the material permanently without severing any of the atomic bonds. In polishing the surface, material is made to flow plastically resulting in a layer of amorphous metal, although it cannot be said that this layer is free from scratches. We therefore must conclude that polishing, and lapping as well, are processes that combine the operations of both cutting and forming.

Forming operations are as follows:

Press forming
Bumping-riveting
Die-casting
Extending
Rolling and drawing
Lapping
Polishing

Standard and special machines have been developed to perform the cutting and forming operations in accordance with the four general factors. In the case of the cutting operations there are three general requirements imposed by these factors in the design of a machine. The requirements are as here listed:

Type and rate of motion of both work and cutting tool should be correct.

Cutting angles, or in general the contour relation between cutting tool and work when the two are cofunctioning, should be correct.

Ability of cutting tool and machine to withstand strains and tendency to chatter when cutting a given material should be ample.

There are, of course, many other considerations, such as convenience for the operator when working with the machine and the adaptability of the machine to work of intricate shape and small or large size.

Considering the first requirement we have rotary and translatory motion of either the tool or the work in accordance with the following combinations:

Machine	Motion of Tool	Motion of Work	Single or Progressive Cutting
Punch press	Translatory	Stationary	Single
Milling	Rotary	Translatory	Progressive
Planing	Stationary	Translatory	Progressive
Shaping, slotting	Translatory	Stationary	Progressive
Lathe	Stationary	Rotary	Progressive
Drill press	Rotary	Stationary	Progressive
Broaching	Translatory	Stationary	Single
Grinding	Rotary	Stationary translatory or rotary	Progressive
Sawing	Translatory	Stationary or translatory	Progressive

The correct rate of motion of a cutting tool with respect to the material, or the cutting speed, depends very largely upon the physical characteristics of the material and the manner in which the cutting is being performed. In punch-press work the motion of the tool is comparatively slow, but the power expended is enormous since the entire cutting is performed in one operation. The same cut performed in the drill press is accomplished progressively with the tool revolving at high speed. The punching tool is blunt as compared with the drill. There are very definite limits, however, to the two methods. In punching, the increase in necessary power becomes impracticable beyond certain metal thicknesses while the cutting speed of a drill is limited by tool temperature which must not run too high, especially in ordinary carbon steel tools.

Reaming, which is used to produce cleaner and more accuate round holes is less severe on the adjacent metal than drilling, while the corresponding operation for rectangular holes, by broaching, lies between punching and drilling in its severity. Planing, shaping and slotting are equally severe on the material being cut. Lathe turning is less severe than any of these three operations, while milling is still less severe. Grinding and polishing are the least severe of all, the latter operation in fact being beneficial to the adjacent material in the piece being worked on.

Effect of Cutting Speeds

The proper speeds for these various cutting methods depend upon the relative severity of distortion on the adjacent material as pointed out above for a given depth of cut. As the depth of cut increases, the cutting speeds naturally decrease.

The cutting speeds are also limited by the nature of the cutting-tool material. Thus with the well-known high-speed steels higher cutting speeds and heavier cuts are possible than for carbon-steel tools. Following are figures showing the extent of the progress made in this direction.

Cut of ⅜-in. depth x ¼-in. feed on a lathe

Material	Cutting speed in feet per minute
Soft Cast Iron	60
Hard Cast Iron	30
Mild Steel	65
Hard Steel	30

Finally, the cutting speeds can be materially increased if a copious stream of coolant is employed to carry away the heat generated in the cutting edge of the tool.

The contour of the tool varies for different types of machine because of the adaptation of each machine to a peculiar contour in the work. For example, the contour relation is illustrated between the tool and the work in a lathe.

The important angles, clearance, top slope and lip angles, are more or less common in all cutting tools, the variation in the tools having to do with the contour conditions met with before the tool edge actually comes in contact with the work. The variation in tool form is extensive. Similarly in the case of planing, shaping or slotting, the general shope of the tool varies within certain limits depending upon the work being done.

Taylor gives the following conclusions regarding the angles at which tools should be ground;

"For standard tools to be used in a machine shop for cutting metals of average quality—Tools for cutting cast iron and the harder steels, beginning with a low limit of hardness of about carbon 0.45 per cent, with 100,000-lb. tensile strength, and 18 per cent stretch should be ground with a clearance angle of 6 deg., back slope of 14 deg., giving a lip angle of 68 degrees.

"For cutting steels softer than carbon, 0.45 per cent having about 100,000-lb. tensile strength and 18 per cent stretch, tools should be ground with a clearance angle of 6 deg., back slope of 8 deg., side slope of 22 deg., giving a lip angle of 61 degrees.

"For shops in which chilled cast iron is cut, a lip angle of 86 to 90 deg. should be used.

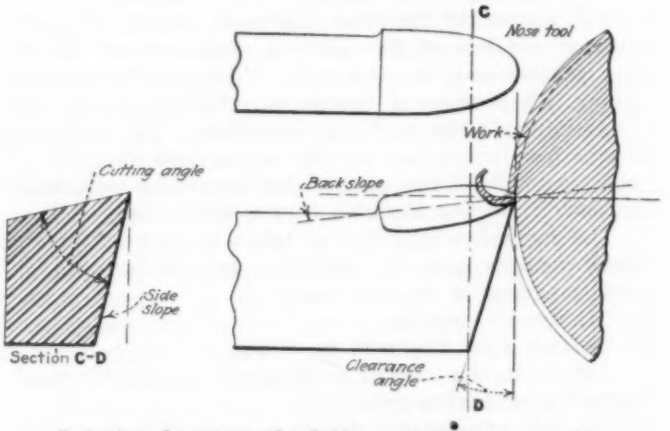
"In shops where work is mainly upon steel as hard or harder than tire steel, tools should be ground with a clearance angle of 6 deg., back slope of 5 deg., side slope of 8 deg., giving a lip angle of 74 degrees.

"In shops working mainly upon extremely soft steels, carbon, 0.05-0.15 per cent, it is probably economical to use tools with lip angles keener than 61 degrees.

"The most important consideration in choosing the lip angle is to make it sufficiently blunt to avoid the danger of crumbling or spalling at the cutting edge.

"Tools ground with a lip angle of about 54 deg., cut softer qualities of steel, and also cast iron, with the least pressure of the chip upon the tool. The pressure upon the tool, however, is not the most important consideration in selecting the lip angle.

"In choosing between side slope and back slope in order to grind a sufficiently acute lip angle, the following considerations, given in the order of their importance, call for a steep side slope and are opposed to a steep back slope;



Relation between the lathe tool and the work

"With side slope, the tool can be ground many more times without weakening it.

"The chip runs off sideways and does not strike the tool posts or clamps.

"The pressure of the chip tends to deflect the tool to one side, and a steep side slope tends to correct this by bringing the resultant line of pressure within the base of the tool.

"It is easier to feed.

"An absence of back slope tends to push the tool and the work apart, and therefore, to cause a slight variation in the size of the work."

The requirement of accuracy involves the machine tool builder entirely, because it is a matter of design in the machine bed, pedestals and extension arms and mode of applying power to operate the machine. The aim in such a design is to give the maximum of rigidity

without chattering of the tool besides other features of less importance such as ease in operation and ruggedness.

According to Taylor the nature of the material being cut is by far the most important consideration in the cutting operation, it affecting the cutting speed about fifteen times as much as the composition of the tool steel and about seventeen times as much as the shape or contour of the cutting edge.

Toughness a Qualitative Term

Certain rubbers are tough and certain kinds of metals lack toughness and are brittle, yet, assuming equal size and similarity in contour, the former material is usually weaker statically. Toughness is a qualitative term which should not be confused with strength which is a quantitative term. Thus in the cutting of a tough rubber and a tough metal, entirely different tools would be used.

Physical properties having an important bearing on the cutting of materials are as follows:

Ultimate strength
Elastic limit
Per cent elongation
Rigidity of work or, for given size and shape, the modulus of elasticity.

These properties, which are definite and measurable, combine and form more indefinite properties which are measurable only in an empirical manner. These latter properties are hardness, toughness and brittleness.

A property like hardness which involves so many of the more definite and fundamental physical properties is naturally very hard to define, the general definition usually given being that hardness is the power of resisting displacement.

According to this definition, we should not encounter great difficulty in measuring hardness in a more exact manner than by the Brinell, Shore or Rockwell methods. However, in meeting the commercial requirements of not destroying the material being tested for hardness, the developers of these tests have confined them to small localized sections with the result that many physical properties are combined. This accounts for the different results obtained by the various methods of measuring this jumble of physical properties called hardness; because some methods are more partial to one physical property than to all of the others.

Since the advent of alloy steels, we have learned that the harder steel is not always the easier to cut. The two additional factors which seem to be necessary to determine machineability are toughness and brittleness. For a given hardness, tough steel is more difficult to cut than brittle steel.

Hardness Is Important

To support this point the terms, hardness, toughness and brittleness should be taken as a unit with the more definite physical properties of ultimate strength, elastic limit, or yield point, and elongation or reduction of area. For hardness, it probably is safe to assign high strength, high elastic limit and high modulus of elasticity as the chief characteristic properties. Then for a given hardness the material would be tough if it had a high elongation and brittle if it had little elongation or reduction of area. As the hardness decreases, the toughness in the previous case would decrease and the brittleness in the corresponding case would increase. While hardness is an important consideration in metal cutting, both toughness and brittleness are the principal qualities which effect cutting speeds and tool angles.

Tools are given sharp edges to produce an intensity of stress directly beneath them sufficient to cause fracture by crushing or shear. They have definite taper angles in order to pry open the intended cut by a bending action. The tools are also contoured to cause the least obstruction between the chips and the tools themselves.

If the cut be light, the force, normal to the top rake or back slope of the tool which prys or bends the chip off, will naturally be smaller than if the cut is heavier. If the tool be sharp the localized stress under the cutting edge will be higher than if the tool is blunt. However, the localized stress produced by a blunt edge may be increased by increasing the force applied to the tool. The extreme limit in this direction is the operation of punching holes in metal which distorts the adjacent metal, overstraining it to the point of brittleness. Hence the method employing the lightest cuts and sharpest tools, such as grinding in the extreme case, affects the adjacent metal the least.

How then do the characteristics of hardness, toughness and brittleness affect the cutting of metals?

Must Possess Brittleness

As the cutting edge of a tool advances into the metal the formation of a chip begins, and, if the metal is tough, the chip bears down on the top surface of the tool with a heavy pressure, while if the metal is brittle, the chip is fractured thus relieving the pressure. The harder the metal the greater will be the pressure of the chip on top of the tool. In the case of very hard and tough metals, the chip persists and grows in length without curling away from the tool clogging on the latter and being hindered in its progress. Clogging and high tool pressure also tend to make the tool "dig in" further than is necessary to give the required depth of cut. Thus machinery brass is easy to cut, particularly if it contains lead which acts as a lubricant to reduce the force of friction corresponding to the normal force exerted by the chip on the top of the tool.

According to Rosenhain a metal, to machine well, must possess a certain degree of brittleness which will allow it to fracture readily and cleanly under the stresses applied by the cutting edge, thus leaving a free-curling turning to flow away from the tool. That this explanation is correct may be inferred from the fact that a small addition of an embrittling element immediately improves the machining qualities of anotherwise difficult metal.

Ordinary soft brass is rendered slightly brittle, and enormously easier to machine, by the addition of a few percent of lead. Aluminum is made distinctly less ductile by the addition of 15 or 20 per cent of zinc. A steel is sometimes employed for the production of screws and bolts in automatics which is intentionally kept in high phosphorus content. This, by slightly increasing brittleness, greatly improves the behavior of the steel under the machine tool.

In other articles published in the *American Machinist* the writer has pointed out that there is a general demand for steels of the air-hardening type with such high physical properties as to make them practically impossible to machine. Designers should bear in mind that although high physical properties favor life and operation, the ultimate cost is apt to be increased due to difficult machine operations.

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

An Efficient Indexing Jig

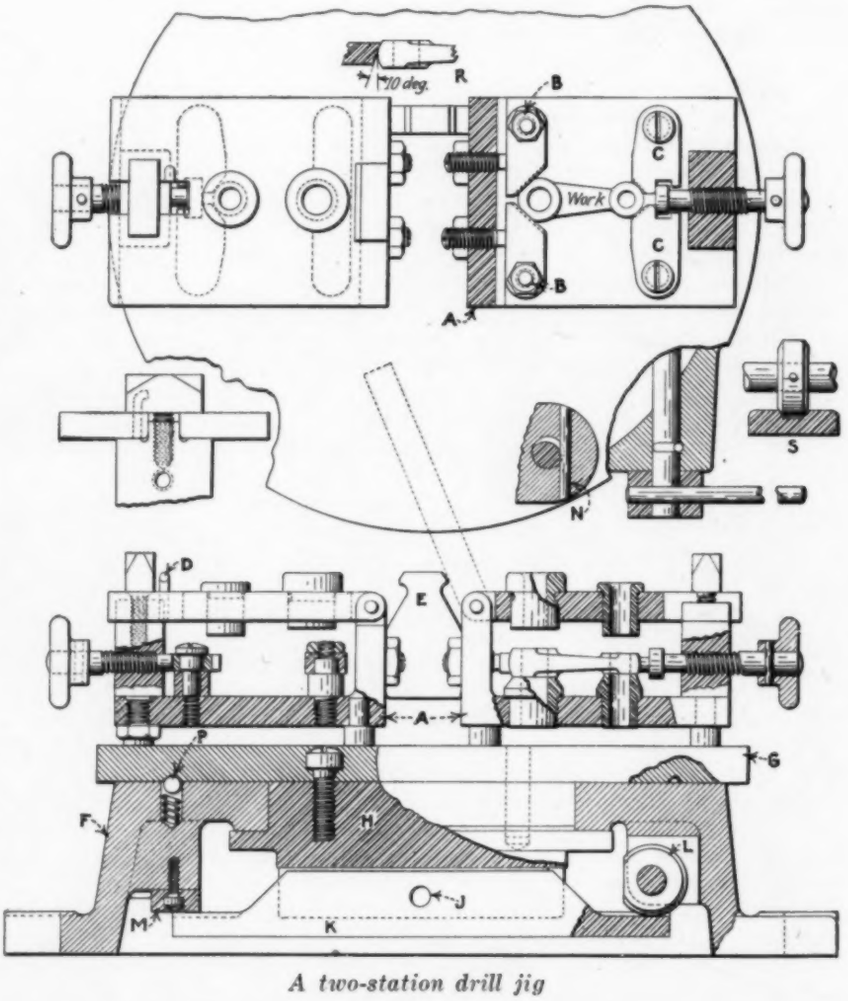
BY FRANK WALDO

Many machining operations are not as easy as they appear, and some of the simplest often offer opportunities for ingenious handling methods that, if adopted, should pay many times over for the special tools and equipment required. This rule is proved in the methods here illustrated for handling small forgings for a drilling operation.

Instead of using one jig as is the usual practice, an indexing base was made and two jigs attached, so that the operator loaded one while the other was in operation. The saving effected by this arrangement paid for the additional jig and the index-base in a short time and, in addition, made available the pattern of the latter for use on similar work. Some of the features in the design of the jig and the base are worthy of adoption for the average work and are shown as a suggested method for the standardization of jigs and fixtures.

The jig is made in built-up form, using an angle-iron body *A* machined all over and provided with four jig feet, a leaf and a leaf support and lock. This style of jig is easy to produce. It can be made in several sizes, suitably stocked, and is applicable for practically all small types of drilling operations. The angle for the body may be machined in a long piece and cut off to the required length. The work is located on two bushings having clearance holes for the drill, and locating surfaces slightly smaller than the size of the portion of the work bearing upon them, so as to insure even wear. Two adjustable V-blocks *B* locate the work at the larger end, the adjustable feature being provided to accommodate any variation that might occur in the batches of forgings. At the smaller end, a V-block composed of two swinging parts *C* is used to clamp and locate the work, the parts being operated by a flanged hand-operated screw that will move them in either direction. All the V-blocks are angular at their locating faces, as shown in the sectional view *R*, to hold the work rigidly against the locating bushings. The leaf carrying the drill bushings is locked by a thumbscrew limited in its motion by the pin *D*. The stop *E* holds the leaf in position shown by the dotted line when it is thrown back for loading purposes.

The indexing table is composed of the base *F*, the table *G*, the center bearing *H* and the rocking lever *K*. The rocking lever, which is symmetrical, clamps and unclamps the table and acts as an index plate to locate the table in the proper position. It is operated by the cam *L*, which is turned to force down one end until the opposite end bears on the plate *M*, then continued pressure draws the table against the base, providing a rigid lock. Upon releasing the pressure applied by



A two-station drill jig

IDEAS FROM PRACTICAL MEN

the cam, so that the flat portion is horizontal, the table carrying the rocking lever can be rotated 180 deg. The view at *S* shows the cam and its angular edge that engages in the lever, assuring an accurate index. The movement of the cam is limited by the arrangement shown at *N* so that the flat portion is rapidly set to the desired position required for indexing. The table is approximately located by the ball *P* that seats in a corresponding "dimple" in the underside of the table when it is swung around. The indexing base is simple in construction, and easy to operate, making its application suitable for drilling, milling, tapping, and similar operations.

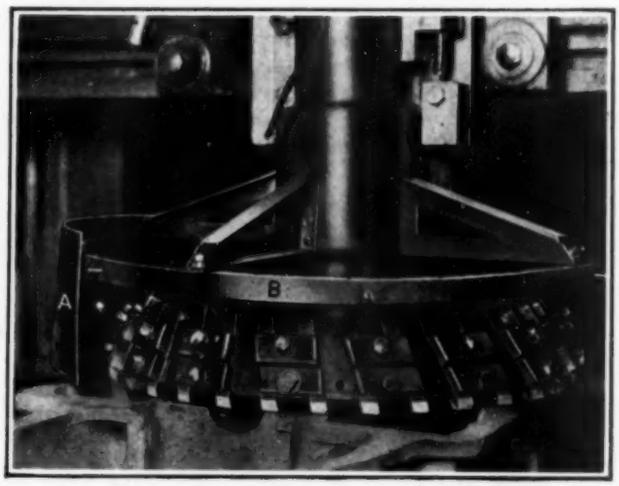
An adjustable two-spindle drill head is used for drilling. The drills run at 750 r.p.m. at a feed of 0.005 in. per revolution and the drilling is completed in 13 sec. Allowing for loading time and necessary losses, the production obtained in 8 hr. averages 1,500 pieces. The general features involved in this operation can be applied to the average drill jig.

Guarding a Large Milling Cutter

By Chester H. Franklin

Some of the large milling cutters being used in milling aluminum crankcases are getting to resemble circular saws, both in size and the speed at which they run. That they are being considered in much the same category is indicated by the way in which they are being guarded in some shops, a good example being shown herewith.

The guard is of fairly heavy sheet metal as may be seen at *A*, and is held to the ring *B* by thumb nuts.



Guard for a large milling cutter

The ring is supported by brackets made from steel angles and welded into proper shape. The ring is also made of angle steel.

With the guards in place, it is very difficult for the operator to get his hands into contact with the revolving blades of the cutter head, thus adding greatly to his safety. If more large and rapidly-revolving cutters were properly guarded, there would be fewer accidents to operators.

Expanding Stub Arbors for Small Jobs

By H. L. Wheeler

A great deal of time may be saved on such work as turning and facing small gearblanks, pulleys, disks, etc., by the use of stub arbors. The necessity for a driving dog, and often for an arbor press, is eliminated by their use, and, when holes are of odd size or oversize and standard arbors do not fit, such tools may save the time that would otherwise be expended in turning up a special arbor.

Two kinds of stub arbors are shown herewith. In the case of Fig. 1, the arbor is designed to be held in a lathe chuck and to be turned or redressed each time it is used. Several sizes may accumulate in course of time and should be kept in a place convenient to select from when one is needed. When a job comes along that may be done on such an arbor, one is selected from the collection, placed in the chuck and turned to fit the hole in the work.

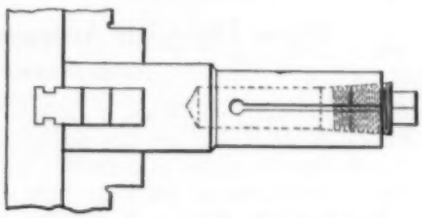


Fig. 1—Inexpensive stub arbor for use in a chuck

These arbors may be made from short pieces of cold-rolled or machine steel by clamping the piece in a lathe chuck, drilling and tapping a hole in the outer end to fit a standard pipe plug, and then slotting. To make the slot, a small crosshole is first drilled through the piece and it is then split parallel with the threaded hole by sawing from the end until the saw kerf meets the crosshole. It is then replaced in the lathe chuck and turned to accommodate the work. With a piece of work on an arbor of this kind, a turn or two of the tapered pipe plug in its thread will tighten it in the hole sufficiently to do light turning and facing.

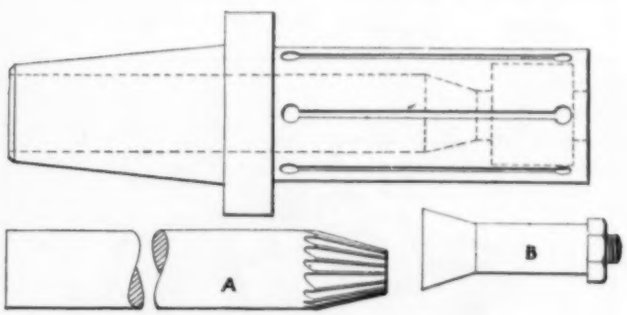


Fig. 2—A more elaborate tool

The arbor shown in Fig. 2 is more elaborate and more expensive to make, being designed for permanence and for one size only. It may, however, be made to accommodate a range of sizes by using it in conjunction with suitable split bushings. Such an arbor should be made of tool steel, hardened, and ground all over.

The shank should be made to conform to the taper hole in the spindle of the lathe in which it is to be

IDEAS FROM PRACTICAL MEN

used. The hole passing axially through the length of the arbor is of two diameters, the larger size being toward the shank end, and at the junction of the two diameters the shoulder is reamed to a taper as shown. It is advisable to recess the smaller hole between the taper seat and the front end in order to make the expanding part more flexible.

The special taper reamer *A* should be made to ream the taper seat for the expanding bolt *B*, and kept to serve that purpose when making replacements, or new arbors of other sizes. The draw-bolt extends through the front end and is provided with a nut. The slots are made by drilling crossholes as shown in the sketch and joining each pair of holes by a saw cut.

Press Die with Automatic Feed

BY JOHN STRAMA

The illustrations, Figs. 1 and 2, show a press construction designed by the writer for manufacturing metal clips in large quantities. The material is half-hard brass 0.011-in. thick by ½-in. wide ribbon stock.

Referring to Fig. 1, it will be seen that the die is provided with an automatic feed mechanism which consists of the roll *A* having fine teeth, the ratchet wheel *B* with five teeth, and the two bearing blocks *C* mounted upon the stripper plate.

The holes in the blocks *C* are counterbored deeper than the thickness of the screw heads which permits placing under each screw head, a compression spring in order to hold the roll *A* under tension upon the material. The arm *D* is pressed toward the ratchet wheel by a tension spring not shown in the photograph. The form of the blanking punches is shown at *E* and the die at *F*. These tools are so made that they cut the scrap away leaving the blanks in one string. The forming punch *G* has a V-opening with the bottom rounded to the shape of the upper half of the finished work.

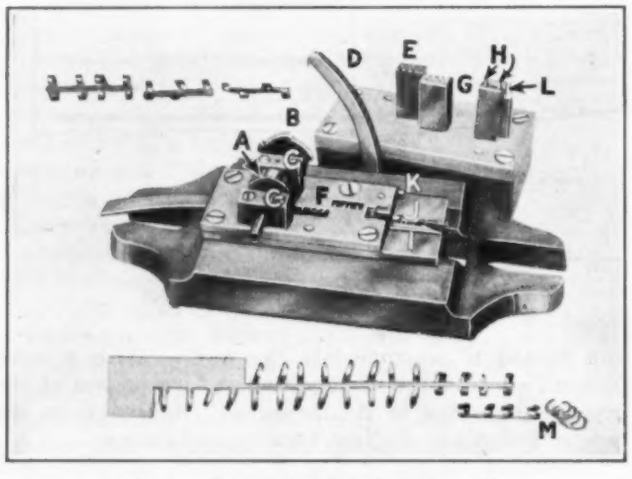


Fig. 1—Press die for forming clips

In that opening, two pins *H* are visible, each under tension of a coil spring. The forming die *I* has a groove with a shape similar to the lower half of the finished work. Above this groove is the pin *J* which is attached to lever *K*, by means of a screw, which transmits the pressure necessary to hold the forming pin high enough above the forming groove to permit the blanks to enter between the forming tool and pin.

The operation of the die is as follows: The strip of material is first fed forward by hand under the roll *A*. As the ram descends the upstroke starts the

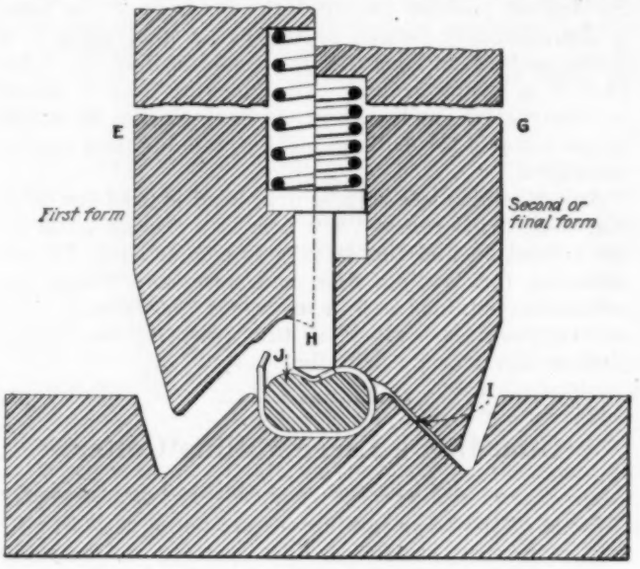


Fig. 2—Cross-section of the forming die

wheel to feed automatically under the first punch *E*, the next stroke under second punch *E*, the third stroke under pin *J*. The coil springs under pins *H* are sufficiently strong to overcome the resistance of the blank, forcing it down into the impression in the forming portion *I* until it strikes the bottom and becomes U-shaped. As the ram descends still further, the pins *H* are forced against the coil spring, and the punch *G* forms the U-shaped blank around pin *J*, giving it the final form as shown at *M*. Finally it is fed under the cutting-off tool *L* and separated from the strip. Therefore one piece is finished and cut off at each stroke of the press. The average production is 70,000 to 75,000 per day.

Fig. 1 also shows the product from three dies of the same type with a slight variation in design, all of which are working successfully. A cross-section of the punch and die is shown in Fig. 2, in which like reference letters refer to like parts.

Steadyrest Jaws

BY JOHN SYLVESTER

At some time or other nearly every lathe hand has had trouble from steadyrest jaws scratching, scoring or otherwise marring finished work.

I tried various kinds of steadyrest jaws, but have never been satisfied with any of them, until I tried a set made from lignum vitæ. The wood is soft enough to prevent cutting; hard enough to withstand the pressure of heavy cuts; and contains so much natural oil that it does not heat rapidly.

I have had one set of lignum vitæ jaws in use for the last year and they still appear to be as good as when made.

IDEAS FROM PRACTICAL MEN

Cutting Key Slots in Piston Rods

By B. O. Server

Cutting the keyways in piston rods is a mean job without proper equipment. The double-head spline miller was used to some extent in days gone by, but the advent of the modern milling machine has made this job a very easy one in the Grand Trunk shop at Battle Creek, Mich.

Two fixtures are required. One is a V-block with a tongue on the under side at the proper angle to offset

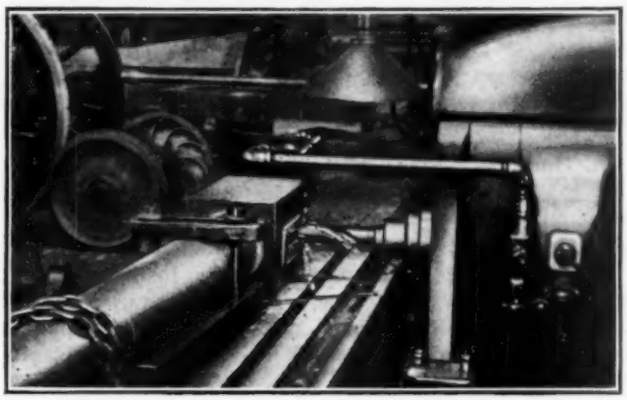


Fig. 1—Drilling the starting hole

the rod for the taper of the key. The other is a drilling jig for the first hole. Both are shown in Fig. 1, which also shows the 1¼-in. drill at work in the rod. Placing the work and drill jig in position takes about 4 minutes.

The hole through a 5-in. rod can be drilled in approximately 5 min. Then the cutter is put through the

Fig. 2—Milling the slot

hole, the arm of the machine adjusted and the slot milled in about 13 min. The milling is shown in Fig. 2, the chips giving a good idea of the kind of cut being taken. The completed job is shown in Fig. 3. It takes about 3 min. to remove the rod from the machine and place it on the floor, making a total of 25 min. As a demonstration, the slots can be milled in less than 20 min. after the first one, and a fair average is a little better than two an hour. The keyway is 1¼x5 inches.

The milling cutter is made from a 4-lip Celfor taper

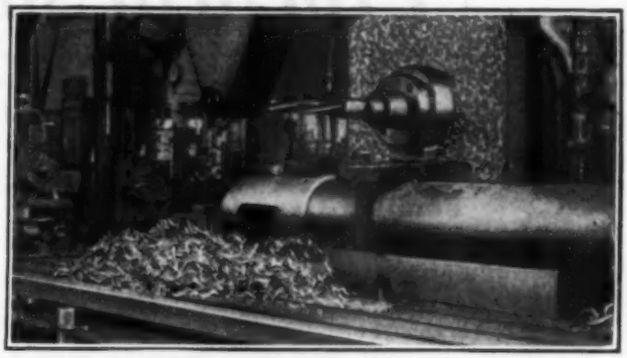


Fig. 3—The completed slot

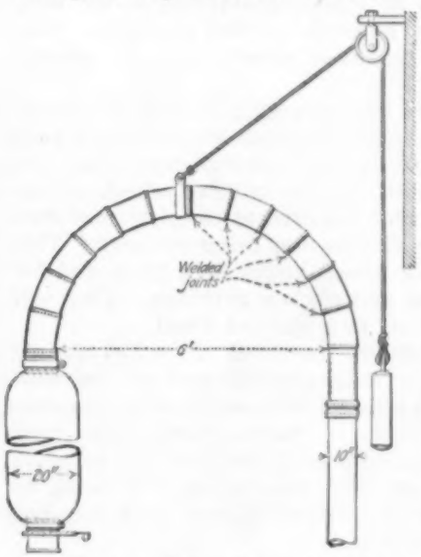
reamer. After wearing undersize as a reamer, it was ground straight, of the right size, and a bronze bushing put on the end to act as an outer bearing. This cutter has milled nearly 40 slots to date without grinding, and is still in good shape.

Repairing a Sheet-Steel Pipe Bend

By E. Andrews

The illustration shows a twelve-piece, 180-deg. pipe bend made from ⅛-in. galvanized-steel sheets. The bend is part of a system recently installed for removing sawdust from woodworking machines and delivering it into freight cars. Previous to the installation of this equipment, the sawdust had been loaded into bags and then transported to the cars for shipment.

A few days after the system had been installed, the bend gave way at several of the riveted joints, which were then reinforced by welding with the oxyacetylene torch.



A sheet-steel bend repaired by welding

In order to insure sound welds, the zinc coating was removed for a distance of about 1 in. each side of the joints. In the welding operation, Swedish-iron rod was used, manipulation of the torch being the same as for welding black iron or steel.

After the welding was completed, the surfaces from which the zinc coating had been removed were given two coats of aluminum paint to protect the metal from rusting.

The bend is now as good or better than it was originally and we believe the welded joints are fully as strong as the steel of which the bend is made.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Painting Over Zinc

Q. What can we do in preparing to paint zinc sheets or galvanized sheets to guard against the possibility of the paint breaking loose.

A. The sheets should of course be thoroughly cleaned of oil, grease, and dirt, and then should be painted with a solution of 8 oz. of copper sulphate per gallon of water. When this has dried, the paint can be applied without any danger of its breaking loose due to any fault of the surface that has been covered.

It should be remembered that a great deal of paint trouble can be traced to the use of an inferior paint without regard to the nature of the material painted.

Grinding Wheel Construction

Q. We desire to know something of the different processes by which grinding wheels are made and the difference between them, in order that we may understand what is meant when a salesman talks of one kind or another. Please also name the principal uses of each.

A. In general there are four processes which are known by the words vitrified, silicate, elastic, and rubber, the words signifying the method of bonding the abrasive grain.

Vitrified wheels are bonded with a mixture of mineral and clay and fused at high temperatures so the bond takes the form of a glass or vitrified porcelain. This form of wheel is the most widely used for general grinding work.

Silicate wheels are bonded with a mixture of silicate of soda (water glass) and minerals which form a hard cement at comparatively low temperatures. They are often used as a substitute for vitrified wheels on account of the short time required to complete manufacture, no period for vitrification being required. This bond is also used for wheels larger than 36-in. and for certain kinds of tool and surface grinding. They will usually not last as long as a vitrified wheel.

Elastic bonded wheels are built up with organic materials, principally shellac, which melt at low temperatures but which attain a permanent set at temperatures somewhat higher. Such wheels are used principally for cutting-off work for they can be made very thin. They are also adapted to such work as ball-race grinding on account of the fine finish they can be made to produce.

Rubber bonds are made of a mixture of minerals and rubber vulcanized, the mixture determining the hardness and toughness of the resulting wheel. They may be used for the same purpose as the electric wheel in cases where more severe service is required as the rubber bond may be made harder and stronger than is possible with shellac. Thick rubber wheels are also correct for hard service on snagging work that calls for a high factor of safety.

Telephone Service in the Shop Cranes

Q. We have a sheet-steel storage which is served from overhead by a traveling crane equipped with magnets so that no one is needed below to hitch on and one man in the cab can do all the handling and deliver to the shop trucks. Unfortunately we have trouble in signaling him for what we want or calling him from the far end of the yard as the air is full of noise from the shops. Can you refer me to some place where this difficulty has been overcome?

A. One pressed-steel plant where conditions are similar to yours has installed a station, from the shop-telephone system, in the crane cab which works to good advantage. This was accomplished by running two trolley wires along the craneway insulated from the track runways of course. Two collectors lead from the trolleys to the phone. If you have no telephone system you could install a bell in the cab in the same way and devise a system of code signals to signify what you want.

Cleaning the Fuel-Oil Tanks

Q. We find, after our fuel oil tanks have been in service for a time, that a sludge forms at the bottom which clogs the burners at our furnaces. We have then to let the oil supply run down and get into the tanks and clean them out. It is a nasty job at best and we would be glad to know what might be done about it.

A. It is necessary to clean fuel-oil tanks periodically but this can be done without getting into them, as follows:

Run the oil out as you have been doing until only the sludge remains. Then fill the tank practically full of water and turn in a steam line or use your heating coils, if you have them installed, to heat the water fairly warm. The open steam line is best as it will agitate the water and break loose the sludge that tends to stick to the bottom and side walls.

The sludge will then rise to the surface of the water where it can be skimmed off. Finally the water can be pumped out and into the next tank to be used again.

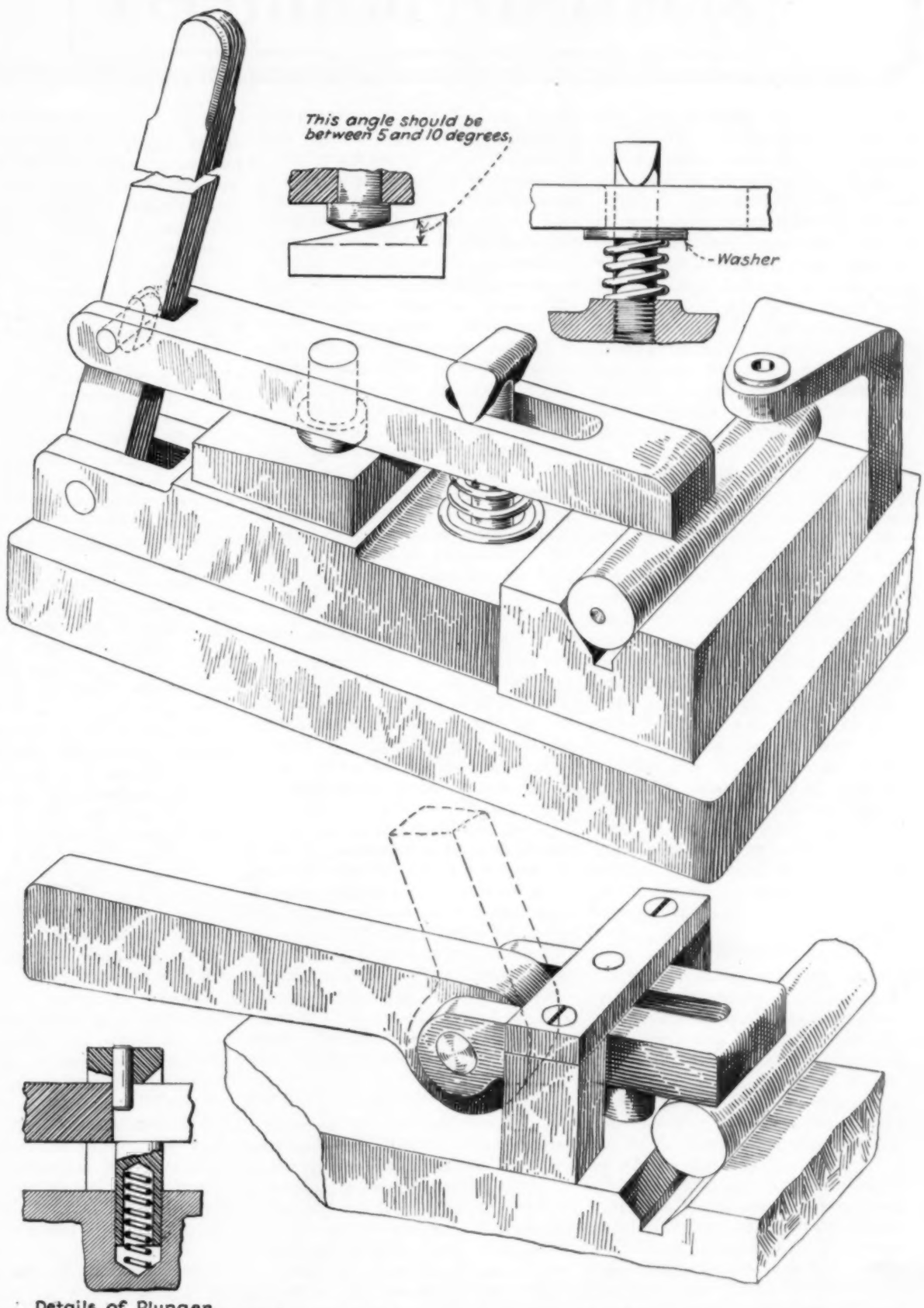
Better than to skim off the sludge by hand, is to make a funnel of sheet metal about 12 in. at the top by 12 in. deep and secure an ejector by its inlet to the small end with a pipe line to the sewer from the delivery.

This funnel can be sunk until its edge is at about the line between sludge and water and the steam turned on. A little urging, only, is required to make the sludge flow over the edge, into the ejector and away to waste.

By arranging the suction line in your tanks on a swivel and float so the intake will be just below the surface of the oil you can keep the suction clear of the sludge as it forms.

Punch here to suit your binder

Clamps for Production Fixtures



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Trim Line

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Technical Abstracts

Factory Conveyors

The Interstate Foundries, Incorporated, Cleveland, Ohio, has effected a 50-per cent reduction in foundry floor space without reducing capacity, by installing continuous power-driven conveyor equipment for handling foundry materials. In this way, production methods have been improved, labor costs reduced, and the foundry brought up to a maximum of efficiency.

Two continuous molding and pouring units with conveyors, and a new sand handling system are the outstanding features. The method for handling the work on the conveyors differs from that used in a number of other foundries having conveyor equipment in that there is no transferring of flasks from the end of one conveyor to another, requiring overhead handling equipment and increased labor costs. There is one continuous movement of molds and flasks on a single conveyor.

Each unit consists of two parallel conveyor tracks that circle at each end to form an endless belt. The molding machines are located along one side of the conveyor, the pouring is done at one end and the molds are shaken out at the other end during which period they have time to cool before being shaken out.—*Iron Age*, Aug. 6, p. 336.

Industrial Accidents

The number of accidents in our modern plants as compared to former times is lower by a considerable percentage according to Russel J. Waldo. Long hours cause more accidents than perhaps anything else upon record. Absence of safeguards follows, with old, wornout machinery next. It is impossible to determine what percentage of accidents is due to the fault of the worker and what is due to mechanical causes. Some stress is being placed on the necessity of the foreman's impressing upon his workers the causes of injuries.

The number of accidents which occur during a man's period of schooling is surprisingly large, although this condition is due to the fact that he knows little or nothing of the machine or task. The plants in isolated communities show a much larger percentage of injuries than the plants in the larger cities. This has been attributed to the fact that the plant in the smaller community does not find it possible to obtain as highly skilled men as those who work in the cities. Workers between 23 and 45 are less subject to injuries than older or younger men. Younger men do not know their work and older men become careless. The accident rate among workers who cannot speak the English language is dangerously high. The best results in accident prevention have been obtained by organizing groups of workers to study and to suggest changes to be made in the plant.—*Industry Illustrated*, July, p. 39.

Furnace Efficiencies

A statement by C. I. Ipsen of the General Electric Co., shows that the efficiency of a furnace must be based on the operating cycle, and it demonstrates by examples that the efficiency of an electric furnace chosen for illustration purposes may range from 33 per cent to 78 per cent, depending on the cycle and the material to be heated. He also shows that the cost of the heat treatment depends on many factors other than the installation cost of furnaces and the cost of fuel, the latter being in many cases less than the other individual factors. The need for a thorough investigation of the overall cost of heat treatment is emphasized.—*Transactions, American Society for Steel Treating*, July, p. 36.

Air-Craft Production Methods

Gardner W. Carr of the Boeing Airplane Co., Seattle, Wash., discusses the question as to whether production method have been adopted in the aircraft industry. Since 1920, four production contracts for bombing airplanes have been placed by the Army Air Service. These are in quantities of twenty, thirty-five, fifty and twenty-five. The Army has also placed three production contracts for pursuit planes, two of which orders were for fifty planes each and the third for 200 planes.

The shop production methods used by various manufacturers in the execution of these contracts are as widely varied as is their physical location. One western manufacturer made up a lot of special tools, dies, and metal jigs for assembly and the drilling of parts in order to eliminate the human element, as far as possible, throughout the contract. Another plant with a contract not much smaller, worked almost entirely by hand and relied largely upon the skill of the operators in the production of details, parts, and in assembly. Special equipment is expensive in every instance and the contractor is faced with the alternative of high priced, skilled labor with low equipment cost or expensive equipment and relatively cheap labor. The question as to how far the airplane manufacturer is justified in bringing production methods into his plant is entirely a local problem. Detailed time study, for example, is of little or no value in an industry where products vary so greatly and change so rapidly. Material-planning on the other hand can and should have a place in every good organization. The scheduling of operations and the dispatch of material is the one system generally adopted.—*U. S. Air Service*, July, p. 37.

Erratum

In the current volume of the *American Machinist*, on page 205, there appeared an abstract from *Advertising and Selling Fortnightly*, entitled "Advertising Machinery Abroad" with the name of E. W. Clark of the Sullivan Machinery Co. given as the author. The author was S. B. King, advertising manager of the Sullivan Machinery Co. and the address was presented before the Engineering Advertising Association of Chicago of which E. W. Clark is president. The error in the author's name was due to the fact that Mr. Clark directed the manuscript to the publisher.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Two Production Policies

AS POINTED out in a recent article in the "American Machinist," there are two policies that can be followed in using machine tools on production work: (1) The machines can be worked to the limit of their capacity with the consequent high maintenance cost, or (2) they can be kept well within their limit and the maintenance cost thereby held low.

Which policy to follow must be decided by each production manager. The adoption of one or the other for the whole shop, however, may not suffice. Both policies will be advisable in the same shop where parts vary from frail to heavy and from small to large. Even different operations on the same part may call for the adoption of both policies.

Some of the things to bear in mind in deciding to push the machine or not are the cost of repairs, whether or not there is need of a special finishing operation, and the advances in design of the machine being considered.

Too much time can be lost and money spent in repairing machines that do not stand up well when crowded. Those machines must be worked well within their theoretical limits and should be replaced by machines of greater stamina if higher production is wanted.

In the choice of running an individual finishing operation or finishing as well as roughing on one machine, a comparison of cost figures will furnish the decision.

Certainly there is something lost if a machine tool is allowed to work along leisurely when design is progressing so rapidly that the machine will have to be taken out of the equipment to make room for a greater producer before it has turned out nearly the work of which it is capable.

Like most questions of importance, the answer to this one of crowding or nursing machine tools is not without attendant difficulties. And like most problems hard to solve the answer will probably be worth much more in dollars than it cost in dollars plus effort.

The President Backs Aviation

IN THE proposed slash in military appropriations, which sets an excellent example to other nations, it is interesting and encouraging to note that President Coolidge appreciates the value of aircraft more than do the heads of the older branches of the service. It is particularly encouraging to find that the appropriation was made with a view to maintaining the aircraft industry in a healthy condition so as to enable it to take care of commercial, as well as military needs.

Those who are not blinded by being too close to the older arms of the service must realize that aircraft development has changed the whole aspect of military operations and that huge armies, with their problems of transport and sustenance, will probably not be a factor, should the world indulge in another great war. Unless all signs fail the centers of military supply, which mean all industrial districts, will be blown up or asphyxiated by one side or the other, before armies or navies can be mobilized—almost before they realize that war has begun. For gas will be used by any nation that feels it necessary to her success regardless of any treaties to the contrary.

Aviation advocates, however, must not lose sight of the fact that aircraft alone is helpless. Without bombs, machine guns and gas, its only use is for observation, as was largely the case in the last war. Both the ordnance and chemical departments are as necessary as aircraft, and they should co-operate to the fullest extent. It should also be thoroughly understood that all these are engineering developments and the personnel should be chosen accordingly. The practice of shifting officers from one service to the other may have some advantages in non-engineering branches of the army, but it is disastrous when it comes to aviation, ordnance or chemical divisions. We have already had too many examples of this in aviation.

Just Suppose

JUST suppose you contract with a builder to build a house for you and that when he has made a good start you decide that the location is not what you thought it was and you cancel the contract, or order. But, you say, you can't get away with anything like that with a building contractor, he would sue you and recover in court. He wouldn't say to you that he would finish up the house and try to dispose of it to somebody else so that he would keep your good will and get the next order you decided to place.

Now suppose business is increasing and to meet your orders you contract for additional machinery. Before it can be built and delivered a slump occurs, orders fall off and, as you can't use the machinery, you cancel the order. But, you say, this is a different case from the other one. The manufacturer of the equipment can't afford to sue you and run the risk of losing all future orders. Well, perhaps that may be true, but,

Just Suppose.

Shop Equipment News

Milwaukee Milling Machines

The Kearney & Trecker Corporation, Milwaukee, Wis., has remodeled its line of Milwaukee Milling Machines, including in the redesign several of the improved features that were developed for its motor-in-base type milling machine that was described on page 33, Vol. 62 of the *American Machinist*. The changes

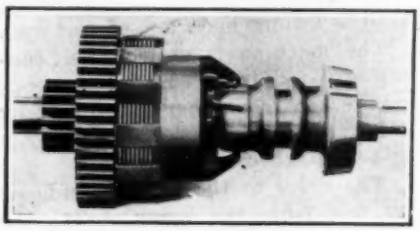

Fig. 3—Detail of the clutch

have been made with a view toward simplifying operation and increasing the efficiency of the machine. Figs. 1 and 2 illustrate the machine.

The power rapid-traverse that has been added to all models larger than the No. 1 and 2S sizes, is operated by the long lever located on the right-hand side of the machine, shown in Fig. 2. By raising the lever, the table is caused to travel at the rate of 100 in. per min., in the same direction in which the power feed is engaged. When the lever is released, the normal table feed is resumed.

An improved form of disk clutch, Fig. 3, has been designed to give a positive drive under full load. The disks are amply separated when disengaged, eliminating all tendencies to drift. A cone-type brake is included in the clutch for bringing the spindle to a quick stop. A pin adjustment is provided for obtaining a uniform drive over the entire frictional area of the clutch. This adjustment can be made rapidly and does not require the use of any tools.

The adjustable starting lever that operates the clutch is located on the left-hand side of the double overarm. By means of the device shown in

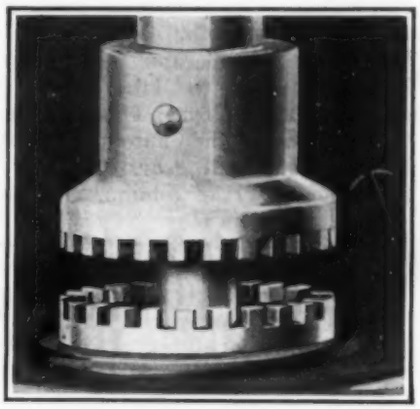

Fig. 4—Lever-positioning clutch

Fig. 4, it may be extended to any convenient position or may be swung completely out of the way to accommodate large work.

Centralized table-feed control is accomplished through a single lever located at the front of the table. By means of this lever the automatic longitudinal feed is engaged in either direction, determined by the lever movement. The action is independent of the other feeds.

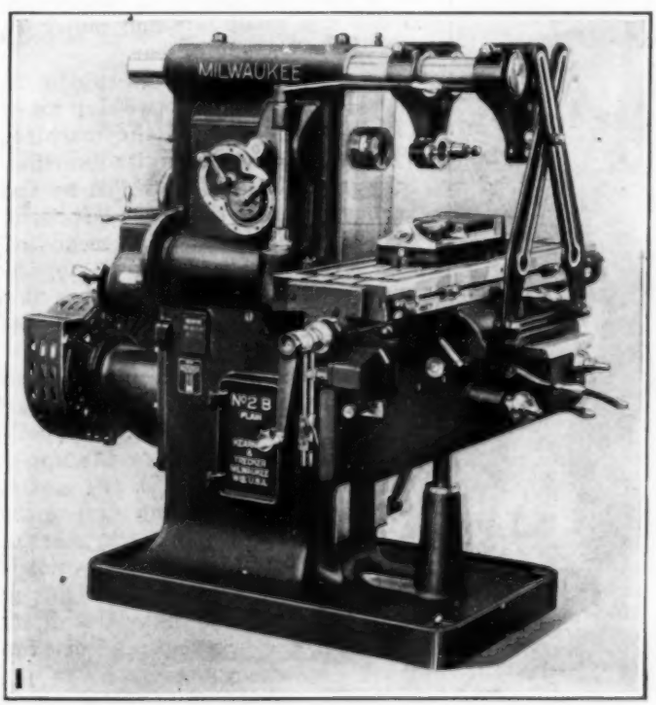

Fig. 1—Milwaukee Milling Machine.

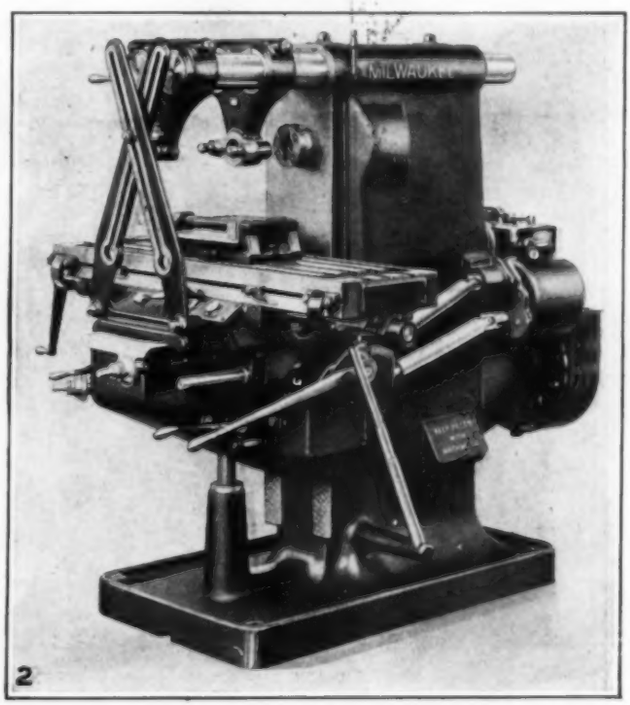

Fig. 2—Left-hand side of machine showing rapid-traverse lever

SHOP EQUIPMENT NEWS

At the front of the saddle on the right-hand side, there has been provided an oil reservoir fitted with tubing which leads to all of the important wearing surfaces in the table and saddle. The prominent location of this reservoir eliminates the likelihood that the operator will fail to lubricate any of the vital parts of the saddle mechanism. This feature, together with the automatic-flood lubrication for all gears and bearings inside of the column, enables practically the entire oiling to be concentrated at but two filling points.

In addition to these changes in design, the company has made provision that all of its line of milling machines, No. 1 to 4, can be obtained with the inclosed motor-in-base type of drive. With this change, the three drives, now optional on all machines, both vertical and horizontal, are the single-pulley belt drive, the external-bracket motor drive and the motor-in-base drive.

Bryant No. 3 Semi-Automatic Hole Grinder

The Bryant Chucking Grinder Co., Springfield, Vermont, has brought out an addition to its line of grinding machines, to be called the No. 3 Semi-Automatic, for the purpose of grinding small holes at a high rate of production. As its name implies, the functions of the machine are partly automatic and impose a minimum of responsibility upon the operator.

The machine incorporates the same general principles as those of the larger sizes made by the same company in that the grinding-wheel head is carried upon a cylindrical bar that both slides and swings in bearings at the top of the head frame and is fed outward radially, with respect to the hole, by the swinging movement, actuated by the cross-feed screw.

The bar, carrying the head has an automatic, reciprocating, traverse movement of sufficient amplitude to grind holes to a depth of 2-in. A further movement may be imparted by means of a hand lever to carry the wheel away from the work in order to gage the latter or remove it from the chuck. The maximum capacity of the chuck is 6½-in. swing.

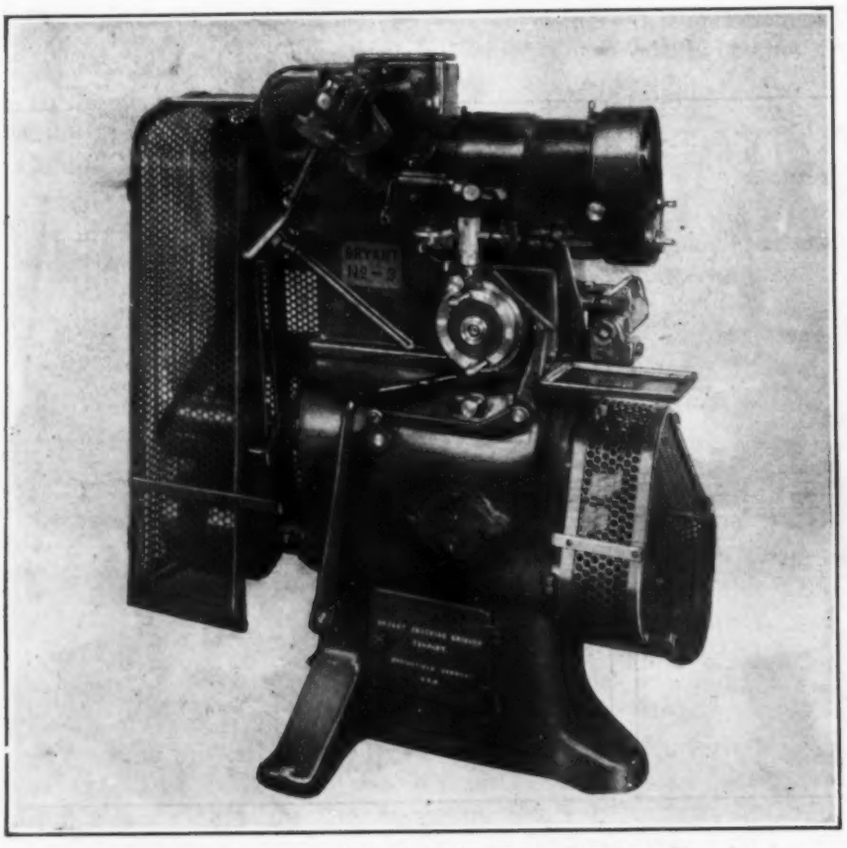

Fig. 1—Byrant Semi-Automatic Hole Grinder, No. 3

Fig. 1 shows a front view of the machine, from which it may be observed that the sliding bar is completely inclosed so that the bearing surfaces are protected from dust and abrasive. It is supported entirely within the head of the machine, thus leaving the work more than ordinarily accessible when the grinding head is swung back out of the way.

The machine is entirely self-contained, requiring no extraneous countershafts whether it is driven by belt from an overhead line or by a motor attached to the base.

The drive to the wheel spindle is by belt from the lower shaft to a secondary shaft that passes through the center of the sliding bar and terminates in a pulley from which an endless canvas belt drives directly to the small pulley on the wheel spindle. The first belt, and also the belt that drives the reciprocating mechanism, are outside the machine to the left and inclosed by wire-mesh guards. A permanent guard of aluminum covers the small belt and pulley at the end of the sliding bar.

The drive to the work-spindle is by a belt running over two-step cones inside the cabinet of the machine. The lower cone takes its bearings in a cradle that is controlled by the vertical lever at the lower left front of the machine. It is by means of this lever that the work is stopped and started. A pneumatic braking device stops the spindle instantly when the lever is moved.

The mechanism to reciprocate the bar runs continuously, but the bar may be disengaged from it by pulling forward the lever at the upper left. The connection between the bar and the reciprocating mechanism is of the nature of a latch, so that by lifting the lever out of its notch the bar may be moved to right or left, at the will of the operator, by corresponding movements of the lever.

The cross-feed is actuated by a screw and finely-pitched ratchet handwheel. The dimensions and

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spacing of the ratchet are such that the automatic feeds advance the wheel in increments of 0.0002 in., or multiples thereof measured on the diameter of the hole being ground. Micrometer graduations upon the perimeter of the wheel assist the operator to size the work with certainty. The automatic feed may be set to knock out at any desired point.

The machine may be equipped with pneumatically - operated chuck or work-holding devices when desired. When the wheel-head is run back by hand for the purpose of gaging or changing the work, a pneumatic device automatically swings the grinding head back out of the way, and it is returned automatically to grinding position when the operator moves the bar forward to reengage the latch.

The Bryant sizing device, which may be furnished as a part of the machine, consists of a diamond-tipped lever that bears continuously on the wall of the hole being ground and registers increase in diameter of the latter upon a dial gage. Fig. 2 shows the application of this device. A wheel-truing diamond is applied by pulling forward the ring to be seen in this illustration.

A geared pump within the cabinet provides an ample supply of cooling medium to the work. A tank in the base contains the liquid.

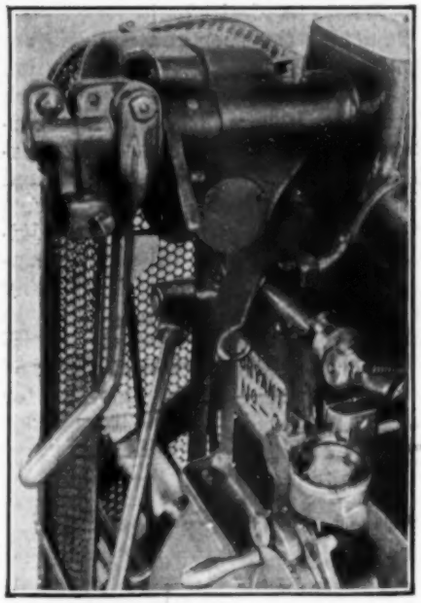


Fig. 2—Detail of sizing device

Both work and wheel-spindles run upon ball bearings, as do all of their driving shafts. Ball-bearing idlers maintain the tension upon both wheel-driving belts. The range of the work-holding chuck is to 6-in. in diameter and holes may be ground to a depth of 2 inches. The machine covers a floor space of 2½ x 3½ ft. The net weight is 1460 pounds.

Elwell-Parker Tructor, Type-ER

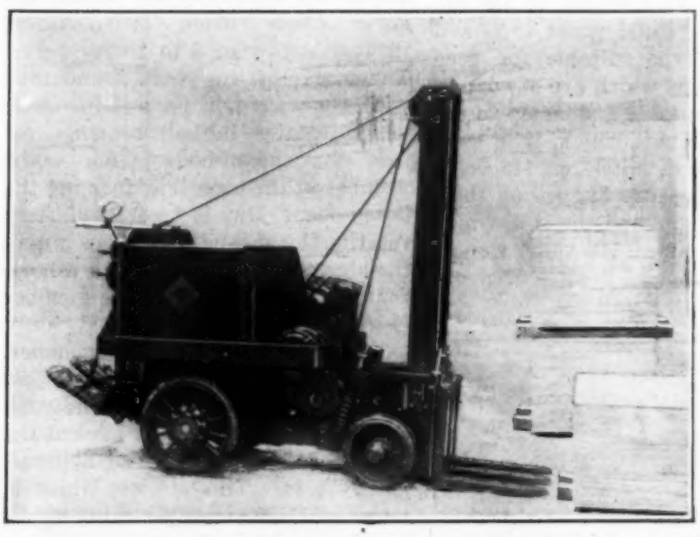
The Elwell-Parker Electric Co., has developed the type-ER tructor illustrated and has added it to its line of material handling equipment. It is intended for picking up materials such as piled sheet metal, radiators, bales, barrels, heat-treating boxes, export cases, machinery, pianos, newsprint, roofing paper and in short, any oddly shaped bulky article.

The unit, which has a capacity range between 3,000 and 5,000 lb., is driven by an electric motor from a storage battery carried on the machine. All four wheels steer in accordance with the company's standard design. Standard safety features are also incorporated. The design calls for balls and rollers at all points of the wheel and motor bearings. The tructor is shown in Fig. 1 in position to approach a load resting on skids on the floor, prior to lifting it by means of the forks and hoisting machinery. In Fig. 2 it is shown in its running position with a load in place.

The vertical upright may be tilted, as shown in Fig. 2, to an angle of 40 deg., the object being to carry the load in an inclined position as in this way sheets of steel will tend to align themselves during the travel of the tructor and the edges will be even when the destination is reached, even though the pile may have been slightly out of alignment at the start.

The vertical movement and rocking motion of the forks is obtained by means of a double-drum electric hoist similar to that used on the company's type-CK crane. The upper drum rocks the frame, while the lower one elevates the load.

The upper-drum cable pulls the vertical uprights toward the operator against the action of a pair of heavy



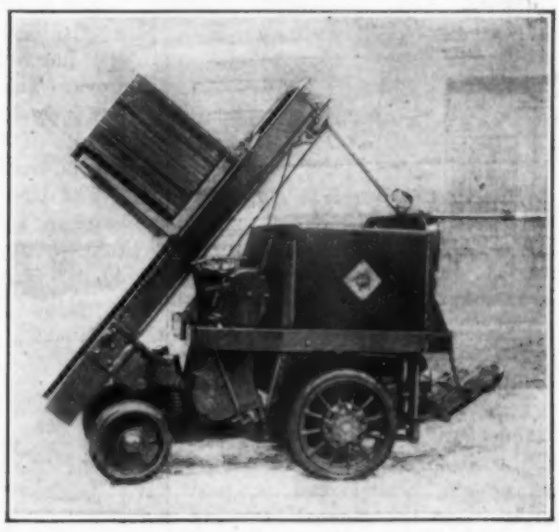


Fig. 1—Elwell-Parker Tructor, Type-ER. Fig. 2—The machine loaded and in running position

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springs as shown in the illustration. These springs with the cable form a cushion rest for the load. When the cable is fully paid out, the uprights pitch forward slightly, which in turn throw the tips of the forks downward for easy insertion below a load.

Each of these two motions is obtained independently of the other when approaching a load. The load can then be lifted and either raised to a greater height or lowered to the floor as the case may be, or it may be inclined to the angle of 40 deg. by rocking the frame, in which position it can be transferred to its destination and placed either on another stack or on properly arranged skids on the floor of a car or warehouse.

Further provision is made for handling the machine in restricted quarters when it is unloaded by arranging the forks so they can be folded back against the uprights.

Liftsaver Combination Hand Truck

The combination hand truck has been developed and is being marketed by the Liftsaver Manufacturing Co., 30 Church St., New York, N. Y., for a number of uses.

As shown in the illustration, the equipment which is of all-steel construction is being used as a rack

Liftsaver Combination Hand Truck

truck carrying a quantity of short angles. In this form it can also be used to handle packages and similar articles.

An extension part and side appendages are included with the truck, the former being detached when not in use and the latter being designed so they can be swung back as shown, and locked in position, to increase the normal carrying capacity.

When so desired the truck can be set on the floor and the side appendages swung into an *A* position so the connecting cross-bar, which carries a roller, forms the top horizontal part of a roller horse to assist in handling structurals, pipe and tubing, and other long materials.

Further, by the use of an additional extension which can be supplied to specification and by using rollers, which are also obtainable, in the notched recesses of the extensions, the truck can be converted to a portable gravity conveyor for unloading cases, crates, and similar articles from cars and trucks.

The design calls for four-point axle suspension, inner and outer hangers, and results in sturdy construction. The handles are bent integral from the side bars. The axle is made of cold-rolled steel.

The company has developed two sizes up to the present time. One, named LU-30, has a length of 54 in. and an extension measuring 30 x 16 in. The other size, HU-36 is 66-in. in length and carries a 36 x 20-in. extension. Other sizes, among them a Liftsaver Junior, which is smaller than the others, are being put into production.

Trent Wide-Tip Soldering Iron

Harold E. Trent, 259 North Lawrence St., Philadelphia, Pa., has added to his line of electrical heating and control appliances an electric soldering iron designed especially for heavy work. Two models of tip are available, the usual spear type and the hatchet type suitable for reed work. The tips which are of copper, are interchangeable and clamp to the handle of the unit which, it is said, can be used indefinitely on 110 volts.

The tips measure 3x¼ in. on their working surfaces and the iron which takes 500 watts at 110 volts, weighs 5¼ lb. Ten feet of flexible cord are provided with the unit.

Trent Wide-Tip Soldering Iron

Unishear Co., "Unishear"

The Unishear Co., 170 Fifth Ave., New York, N. Y. is marketing the electrically-driven shear illustrated. It is intended for production work in various plants for cutting sheet metal and for other flat stock such as copper, aluminum, celluloid or composition. It will handle steel up to 14 gage in thickness and is capable of making a continuous cut on straight or irregular work as rapidly as the material can be fed to follow the given outline.

The shear is mounted at one end of the motor, the shear body and upper

Unishear Co. "Unishear"

jaw being cast integral with one end-frame of the driving motor. The shape of the body is such that a minimum work-diameter of 4 in. can be cut in either direction.

The universal motor which is rated at 400 watts and which can be furnished for 110- or 220-volt d.c. or a.c. current rotates at 5,000 r.p.m. and drives an eccentric, on which the lower shear blade is mounted, through a pair of 4 to 1 spur gears. The larger of the gears is mounted with the eccentric on a ¾-in. shaft which rotates in ball bearings set into the shear body. The outer member of the eccentric, forming the lower shear jaw, is restrained from rotating by means of a steel pin in the shear body around which a horizontal U-shaped slide on the member is guided. It rides on a heavy-duty ball bearing on the inner member. The resulting action of the lower jaw is therefore an oscillating one with a total movement up and toward the throat of the upper jaw of approximately ⅛ in. This motion, which is repeated 1,250 times per min., moves the lower blade to cover and un-

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cover approximately ¼ in. of the cutting edge. The total length of the knives is 2 inches.

A very slight pressure toward the throat of the shear is sufficient assistance to the feeding action of the lower jaw to carry the work along rapidly. Relieving the pressure results in immediately stopping further action as the jaws will not feed of themselves.

The rotor of the motor, as well as the moving parts of the shear are mounted on ball bearings. A spring at the outer end of the rotor shaft keeps out any rotor end-play.

On the shear end of the rotor, a centrifugal ventilating fan is mounted to draw air in through ventilators around the outer end to successively pass the commutator, the brushes, rotor and fields and emerge from holes in the shear-end housing.

The bearings are packed in grease supplied through a cover at the outer end and renewed at the shear end through a small grease cup.

Access is had to the brushes by removing the ventilator plates while the entire machine can be taken down by removing two through-bolts.

On the rear of the main frame, which also forms the base of the machine, a snap switch is mounted and supplied with 10 ft. of armored cable for attachment to any convenient lamp socket.

High-speed steel is used for the easily removable shear blades while the rotor and eccentric shafts, and the gears are made of alloy-steel hardened and ground to size. The outer end-frame is of aluminum with the main frame and shear body made of cast iron. The unit measures approximately 12x12 in. and stands 10 in. high. It weighs 38 pounds.

Armstrong-Stillson Frameless Pipe Wrench

The Armstrong Brothers Tool Co., 315 North Francisco Ave., Chicago, Ill., has made a number of improvements to its pipe wrenches, which are now incorporated in the frameless pipe wrench illustrated.

The original frame or nut housing has been eliminated and the nut has been converted to a ball and socket design to give increased flexibility and greater uniform bearing.

The side-pull strain is now taken

Armstrong-Stillson Frameless Pipe Wrench

up by two solid forged steel lugs which project into a recess in the end of the nut and are thereby reinforced or tied together.

The arrangement of the spring in-

Chambersburg Hydro-Pneumatic Press 300-Ton

The self-contained hydro-pneumatic press, illustrated in the 300-ton size, is a product of the Chambersburg Engineering Co., of Chambersburg, Pa., and is an adaptation of the standard bushing press made by the company.

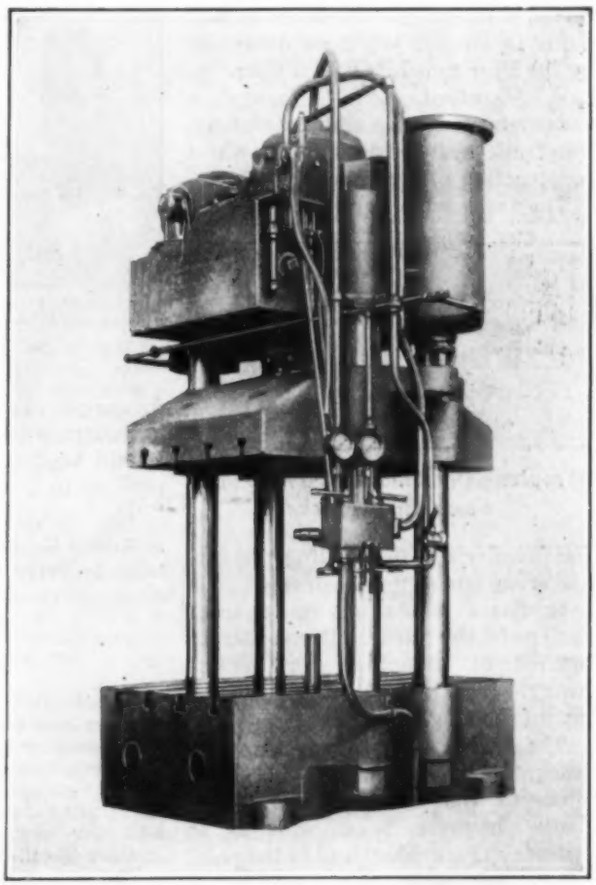
It is particularly designed for the rapid production of small shapes in dies, for use in producing car diaphrams, stiffeners, gussets and similar work in railroad and car shops, and for work on the bending and straightening of sills, plates and kindred parts.

The speed with which the press can be operated is due to the design that utilizes shop air pressure for the movement of the platen and stripping ram, to and from the work, and that employs a hydraulic pump for the actual press work only. The pump is motor-driven and is mounted on the upper platen.

Aside from being equipped with four columns and having pneumatic pullback, the press is of the same design and construction and embodies all of the features and accessibility, ease of control, and reliability which are claimed for the standard bushing press that has been on the market for some length of time.

Capacities range from 200 tons up and the design is such that the special features which are required to adapt the machine to the requirements of railroad, automotive and general machine-shop work can be incorporated to specification.

Control levers and operating valves are grouped at the side of the machine and gages are provided to keep track of the pressures. The mounting of the pump on the top platen conserves space and makes the machine practically self contained. The bottom platen is arranged with a blank-holder, knockout cylinder and piston which is operated from the central control station.



Chambersburg Hydro-Pneumatic Press, 300-Ton

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sures the proper gripping position to the movable jaw and imparts correct tension to prevent the nut from overhauling.

The steel lugs and the V-clamp which are on opposite sides of the nut are positioned so the nut cannot fall out when the movable jaw is removed for any reason.

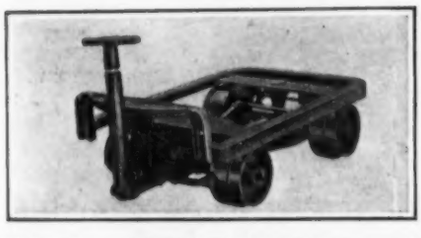
Since the handle is not limited in size due to the absence of the frame it has been made strongest at the point of greatest strain.

It is finally claimed that the parts are self-cleaning in action and will therefore not clog or gum up. The wrench is made in six sizes ranging from 8 to 36 in. in length with corresponding capacities to handle pipe between ⅛ and 3½ inches.

Plimpton Combination Track and Floor Lift Truck

The combination lift truck which can be used either on a track or on the floor and which can be transferred from one to the other at any point in transit has been developed by the Plimpton Lift Truck Corporation, Stamford, Conn. Turntables and switches can be eliminated from the track system due to its wheel construction and alignment control.

The truck was designed originally



Plimpton Combination Track and Floor Lift Trucks

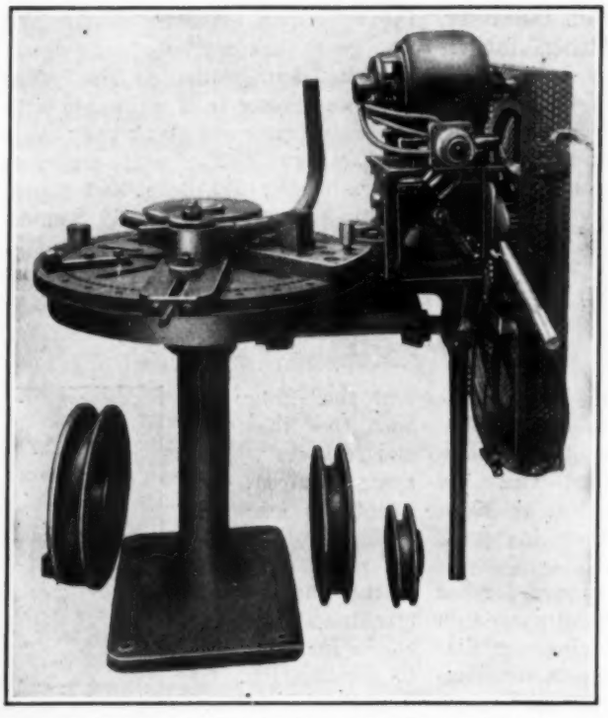
for foundry use in handling pig iron and scrap where it is desirable to run over floors inside but on a track system in the yards. It can also be applied to advantage for general heavy trucking throughout the manufacturing departments.

The wheels are made to run on a track, having a flange to guide them in the usual manner. This flange, however, is as wide as an ordinary truck wheel and is the point of support when the truck is operated over a floor. Automobile-type steering knuckles retain quadrangular wheel spacing to assist in tracking and in making turns on plain surfaces.

There are three sizes in the line, for loads up to 5,000 lbs., that all measure 11¼ in. in height by 30 in. wide. In length they measure 44 in., 58 in. and 72 in. respectively.

Pedrick Horizontal Pipe-Bending Machine

The Pedrick Tool & Machine Co., 3640 North Lawrence Street, Philadelphia, Pa., has added the motor-driven pipe bender to its line of similar-purpose hand-operated machines. It will handle miscellaneous work in pipe up to 2 in. standard.



Pedrick Horizontal Pipe-Bending Machine

The motor is mounted on the standard to the right of the machine table to drive the faceplate in either direction through a train of gearing. A lever, conveniently located, sets the gears for forward, stop or reverse while the motor, which is started by means of a rheostat mounted below it, is allowed to run in one direction continuously. The faceplate is fully inclosed and the driving teeth protected within the main table.

The bending roll, which is made to fit the size of pipe to be bent and the radius required, is mounted in a stationary position on a stud at the center of the table. A bending arm is bolted to slots in the faceplate at the right location for the piece of work in question and serves to wrap the pipe around the roll. A resistance arm, which has free radial movement, is set at the desired position and secured by means of a pin through it in holes evenly spaced around the top rim of the table. The arm is arranged with a nest of holes for locating and supporting the saddle against which the end of the work presses while the bend is being made. With the flexibility of this arrangement of bending arm and resistance arm both with respect to each other and with respect to the table, a wide range of bends is made possible.

To further control the movement of the faceplate and to facilitate repetition bending, a stop pin is provided to set in the holes in the rim of the table together with a stop plate and adjustable screw.

Foundry Production Gains in July

The Department of Commerce announces July bookings of steel castings, based on reports from principal manufacturers, representing over two-thirds of the commercial-castings capacity of the United States, as 54,474 tons, or 54.2 per cent of shop capacity, as against 48,413 tons in June.

The report shows the bookings of commercial steel castings for the past nineteen months by sixty-eight identical companies, with a monthly capacity of 100,400 tons in 1924 and 1925 of which 43,000 tons are usually devoted to railway specialties and 57,400 to miscellaneous castings. This total capacity compared with 100,000 tons capacity of these firms in 1923 and 97,350 tons in 1922 the capacity devoted to railway specialties comparing with 41,900 tons in 1923 and 39,800 tons in 1922 and miscellaneous capacity comparing with 58,100 tons in 1923 and 57,550 tons in 1922.

News of the Week

Court Upholds Right of Employers to Fix Wages in Indiana Shops

Expect latest decision will have far reaching effect

Indiana tool and machinery manufacturers, in addition to being permitted to form organizations for usual association business, now may include in association activities the fixing of maximum wages for employees, according to a recent ruling of the Indiana Appellate Court. Not only that, but one factory owner having entered into the agreement dare not break it and pay more than the maximum wage, else the others have recourse at law in much the same manner as if any contract were broken.

The decision, which applies to all employers of labor, is believed to be the first ever given on this question by any higher court in any state. It recognizes the right of employers to fix maximum wages that shall be paid for any sort of work. It not only will bind Indiana directly, but will have a precedent bearing in courts of other states where employers of labor form associations and seek to regulate wages.

Say, for example, the trade in Indianapolis should agree that the maximum wages of machinists should be 80 cents an hour. After this agreement had been made, times improved and machinists became scarce. One company in order to get necessary help employed machinists at 85 cents an hour. This company and its executive then is guilty, in Indiana, of violation of an agreement and a suit against it for damages on the part of the others would have a standing in court.

A Concrete Case

In the case just decided by the court the employers had banded together and said the rate of pay for a certain piece of work was to be $1 an hour. The defendant had given a bond of $1,000 that he would abide by the agreement, as had all other parties to it. It was found, however, that in order to secure labor, the defendant had paid $1.25 an hour in some cases. Suit was brought in the county courts for $1,000 damages against the defendant and his bondsman. The lower court upheld the agreement and the case was appealed.

The opinion of the higher court says: "In Indiana the law recognizes the right of laboring men to combine to promote their own interests and to enforce their combinations by any lawful means, even to the extent of picketing an employer's premises. If the employee has the right to say what wages he will work for, the employer should have the right to say what wages he will pay. If men lawfully combine to accept a minimum wage which they fix and may enforce that combination among themselves by fines, suspension or other form of discipline, employers likewise may form a combination for any lawful purpose, including the fixing of a maximum wage and enforce it by the same means available to the employees.

"If labor organizations and similar associations did not have the right to enforce compliance and submission to their rules, regulations and bylaws, they would be powerless and the courts have upheld such organizations as long as they are organized for a lawful purpose, and will aid them in carrying out and enforcing all contracts with reference to the same."

Exposition of Power and Mechanical Engineering in New York

The fourth national exposition of power and mechanical engineering will be held in the Grand Central Palace, New York, from Nov. 30 through Dec. 5. The Power Show, as this exhibition is styled, is a clearing house of information for executives and engineers in all industries. In this it is different from the exhibitions devoted to the equipment of a single industry, as power is a fundamental factor in every industry and a showing of the machines and apparatus required for its economical generation and use gives an opportunity to every industrial executive to discover some means of cutting his promotion costs.

Broadened Scope

At the coming show a series of exhibits of heating and ventilating machinery will form an important addition to the lines usually represented. This broadening of the scope of the show is an acknowledgment of the increased importance that manufacturers now attach to the need for modern methods in the factory.

The list of exhibitors to whom space has already been assigned indicates the thoroughness with which the field of power generation and use will be covered. From the handling of the coal to the boiler to use of power at the shaft, from the hand shovel to the elaborate coal handling and storing equipment, and from the belt fastener to the enormous pressure mover, every class of device, machine, apparatus or process that enters into power generation and use will be represented. Combustion equipment, valves and fittings for high temperature service, measuring and recording instruments, nonferrous metals and prime movers will have their usual prominent part.

As usual, the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers will be held during the week of the show and their programs have been planned to allow opportunity for a thorough inspection of the exhibits.

Western Electric Out of Foreign Field

The Western Electric Co. plans to withdraw from the foreign field of telephone competition, it was made known last week when officials of the company announced the sale of its foreign subsidiary, the International Western Electric Co., to the International Telephone and Telegraph Corporation.

"With the American business of the Western Electric Co. making increasing demands upon it, and in view of its primary obligation to the Bell system, the operations of which are confined to the United States," said a statement issued by the company, "the Western Electric has decided to devote its resources to business within the United States."

Announcement was also made of the purchase by the International Telephone and Telegraph Corporation of a controlling interest in the Mexican Telephone and Telegraph Co., which has recently been granted two new concessions in the southern republic. The Mexican company has been established for about twenty years.

Hudson Places Million-Dollar Order with Bliss

The E. W. Bliss Co. has just received what is said to be the largest single order for sheet-metal working machinery ever placed. The order was for more than $1,000,000 worth of equipment for body and fender manufacture. It was placed by the Hudson Motor Car Co. for use in the new body building plant in Detroit. Presses of practically every type were included in the order, from the small bench machines up to machines 150 tons in weight. The number of machines on the order was approximately 350. It is expected that the greater part of this machinery will have been delivered and will be in operation in the new factory by the first of the year.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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EXPERIENCED students of financial history are beginning to show concern over recent developments in the New York stock market and the security markets in other cities that follow the lead of New York.

Thus the financial article in last Wednesday's *New York Times* says, "Speculation on the New York Stock Exchange yesterday became a pathological not a financial phenomenon. The movement of prices for the highly manipulated shares proved, if it has not been sufficiently proved already, that the speculative fraternity is no longer in an entirely sane condition."

To their credit most bankers and brokers are cautioning their clients against buying stocks at what are for many the highest prices on record; but as is usual in such cases the warnings of the conservatives are unheeded by those who assert that we are in a "new era," for which history offers no precedent.

That may be true but anyone whose experience goes back 35 years will recollect how the "new era" of 1890 was brought to a sudden close by the difficulties in which the Baring Brothers then became involved, and how other "new eras" were unexpectedly ended by such happenings as Cleveland's Venezuela message, Governor Flower's death, the sinking of the Maine, McKinley's assassination, the Northern Pacific Corner, the suspension of the Knickerbocker Trust Co. in 1907, and last but not least, the World War that was thought impossible on July 20, but was nevertheless begun on July 31, 1914.

These crises of a comparatively recent past are not recalled in a spirit of pessimism for present conditions are indubitably sound. But that they are menaced by the recklessness with which unseasoned shares are being bid up there can be no doubt, and an unexpected something that will check a movement so factitious and dangerous is almost sure to happen.

That experienced investors appreciate the artificiality of the stock market is shown by the slack demand for bonds even at lower prices as well as by the inertness of commodity speculation which is restrained by a fear of a collapse on the Stock Exchange.

But general business on the whole is good, distribution is perhaps better than normal, and prices have moved logically in response to influences that are seasonal.

The wheat market was rather a dull affair during the week, with the tightness of nearby cash wheat still the dominant factor. Sentiment in the trade is distinctly bullish but speculators hesitate to push advances as our markets are already so far out of line with foreign wheat values.

What's Doing in Industry

There has been little change in the machine tool situation in the past week. The second half of August has apparently brought a slackening in activity in practically all lines of machinery, when reports from all of the industrial centers are averaged. However, reports from the largest centers show that this condition is not universal.

New inquiries are coming into the market, which is taken as an indication that future business will more than make up for any present dullness.

Cincinnati, the center of an active market, reports a slight increase in sales, but the demand is spotty. Chicago also reports better business, with the expectation that August will exceed previous months this year. Indianapolis has little to report in the way of current orders, but prospects forecast an active demand as soon as the vacation season has passed. In Cleveland the machine tool builders and other industrials are busier than they were last month, extra working shifts being necessary in a few instances.

The New York market continues at an even pace, with no special activity marking the week. Buffalo is quiet, orders being confined to single pieces of special design. The same situation prevails in Canada. New England reports a seasonal dullness, but more inquiries that portend greater activity in the fall.

The general business situation is healthy, and opinion persists that if over-speculation in stocks and real estate does not persist, good times should prevail.

Coffee is in a position that warrants the attention of grocers and their customers. Secretary Hoover points out that our importations of coffee for the year ended June 30, 1925, were 10 per cent less than those of the previous twelve months. The decrease is attributed to the advance in prices resulting from Brazilian valorization. He suggests that our importers should be allowed to combine so that they may oppose more effectively the maintenance of an artificially high price.

Cotton goods are moving in fair volume and spinners have been buyers of spots in the South but the futures market is still held in check by the fear that the next government estimate will confirm the popular belief in a crop of at least 14,000,000 bales. It is questionable whether such a supply would be excessive but in its present mood the trade is disposed to assume that it would be bearish. Wool and woolen goods show but little change. Some experts say that lower wool is unlikely but the ultimate consumer of woolen fabrics is buying sparingly and the Department of Agriculture states that lower prices in 1926 are probable unless there should be an increase in demand. Steel and iron are practically unchanged, copper continues firm at 14¼, and lumber is steady. Numerous cuts in automobile prices have been announced, but this is not to be interpreted as an indication of depression in that industry. Motor car sales have held up unusually well during the summer months and western agricultural prosperity is expected to bring a larger demand than usual throughout the fall.

Freight car loadings for the previous week again attained new record levels, but it is worth noting here that these figures do not necessarily indicate a record volume of business. Revenue ton mileage is a more accurate indicator of business conditions, and in this era of hand to mouth buying ton-mileage runs lighter than car loadings seem to show.

The statisticians have endorsed the Department of Labor's warning against overbuilding. But people continue, nevertheless, to buy land and erect new buildings, and the construction for 1925 will probably be the largest on record.

This is the month of political vacations in Europe and conditions there require no comment. The Belgian debt settlement has been agreed upon and most other questions are in *status quo*. Nothing that will acutely affect America has happened or appears likely to happen in the near future, and if the people of this country do not become the victims of their own enthusiasm by over-speculation in stocks and town lots the good times we are enjoying ought to continue.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New England

The machinery industry in the New England territory is feeling some of the customary August dullness, yet it is not so noticeable as in past years, and the number of inquiries coming in at this time contributes to the optimism generally prevailing.

Foreign demand for special machinery and for heavy production equipment is good.

The volume of domestic business keeps up satisfactorily but there is room for improvement in the heavy machinery trade.

Estimates are made that August business will be from 10 to 15 per cent better than in August last year.

Manufacturers having business with companies producing agricultural equipment report improvement in conditions. Chain manufacturers in Bridgeport report that buying is improving. Hand tool business is better. Automobile trade contracts placed and in prospect are increasing.

Indianapolis

Some encouraging signs are to be seen in the local machinery and tool trade. However, business remains spotty. This spottiness is causing much conjecture because of its very nature. The automobile industry is a typical example. Sales both of tools and machinery to some of the larger plants are very active and to other plants virtually nil. The same condition is true in several other trades. An increase in inquiries and some additional sales both of machinery and tools is seen to the coal trade in the western part of the state. During the last few weeks many mines have been reopened after months of idleness and the last two weeks have witnessed increased activity on the part of others.

The demand from the farm implement trade which has been considerable for the past six months, has dropped off a bit. Most of the production for this season has been completed and it will be winter before many of the factories begin production for next spring. However, it is expected that some of the plants will spend the off season in making extensions and replacements that should keep business to a fair level.

Railroad demand is picking up. Advices from the local trade show some roads are revising their repair programs toward expansion before cold weather. A fair demand continues for woodworking machinery both for lumber factories and the furniture industry.

Buffalo

With the possible exception of contractors' equipment, the machinery business here is quiet. A great many of the leaders in the business in this district are on their vacations.

Reports show a duller condition than at any time this year and a marked re-action from the slight flurry of business indicated in late July and early August. However, there was no pessimism among the dealers who were on the job. Without exception they predict a good fall business.

Inquiries are rather general. Most industries in this district are in good shape, with the exception of steel. Outside of the steel business, however, industries have been busy and the machine tool dealers feel that most of the possible buyers have money with which to do business this fall.

It seems to be the general belief, however, that most of the sales within the next few months will be made in special equipment.

Buffalo motor and motor accessory companies are in good condition. The comeback of Pierce-Arrow has led to many rumors of mergers, which, however, are not taken very seriously at this time.

Chicago

The season considered, an encouraging volume of business in the machine tool industry is reported by most dealers, some of them particularly those who specialize in used machinery, going so far as to declare that thus far the month of August has almost set a record for sales. Not all dealers report an active demand, however, but complaints of no business, such as were common during the early spring, are rare.

Railroad buying seems to have taken a new spurt, the Rock Island, Santa Fe, Burlington, Illinois Central and C. M. & St. P. having either made inquiries for or purchased several needed tools in the last few days. Manufacturers of radio equipment are expected to come into the market soon for needed machinery to meet an increased production preceding winter. The Board of Education has placed a number of orders during the last week for high and tech school machine shop equipment.

Cleveland

The continued absence of the usual midsummer dullness is the feature of the machine tool industry in the Cleveland district. Manufacturers report conditions as being good. Several plants have employed extra mechanics and are working extra shifts in order to finish present orders. Inquiries are on the increase and a busy fall is predicted.

Among the orders received by a local manufacturer of open side planers were from the American Steel and Wire Co., and the Federal Match Co., of Cleveland; Price Brothers, Detroit; the Pullman Co., Chicago; and the Schwarz Foundry Co., Detroit. Most of this business was reorders, indicating that expansions are in progress.

New York

Activity in the local machine tool market has been limited in the past week to scattered orders for various types of equipment needed for some specific work. The business volume that was experienced in July has tapered off in August, and the probable reason is the general slowing up of industrial activity in the most important vacation month of the year. It is said by dealers that many orders for machine tools and shop equipment have been held up pending the approval of executives who are at this time enjoying their yearly leisure.

Few new inquiries have appeared of late, but it is stated on good authority that the railroads are busy preparing new specifications for tools they will buy in the fall. The automotive trade has about finished its buying for this season, and general manufacturers are not calling for anything but special purpose machinery.

The second-hand market is fairly active, sales being reported regularly for standard machines for various kinds of work.

Cincinnati

A slight increase in sales in the past week is reported by machine tool manufacturers. There is a lot of potential business in the air, inert at present, but on the verge of becoming active.

Now that the vacation season has about closed, selling agencies expect an increased amount of orders. Inquiries coming in, it is stated, indicate that machine tool users are beginning to give a greater amount of thought to the matter of increasing output and decreasing costs.

There has been a slight increase in the number of orders and inquiries sent in by railroads, and it is freely predicted that the heavy grain movements now commencing will compel them to make long-deferred purchases of machine tools, in order to keep equipment in order.

The automotive industries have made some purchases of machine tools in the past week, but no large orders are reported.

Canada

Despite the mid-summer dullness in business generally, there is considerable activity in the metal-working industry in Canada. Manufacturers of machine tools report a steady flow of orders for single tools. Sales throughout Eastern Canada are reported to be satisfactory and slightly better than a year ago.

It is learned that a substantial increase in the operations of the British Empire Steel Corporation mills at Sydney, Nova Scotia, will take place soon. The blooming and billet mills opened Aug. 24.

Reports from Toronto are to the effect that metal dealers, chiefly non-ferrous, have booked an encouraging volume of business, irrespective of seasonal depression. Small orders still characterize buying, but prospects are bright for considerable activity late in the summer.

Detroit

Representatives of machinery and machine tool companies report brisk business in Detroit and nearby industrial centers.

The present demand is for special machinery which will eliminate hand work, speed up production and cut down costs. Hudson-Essex, which has just announced the fourth price cut this year, is buying more tools than for some time. Replacement of old machinery is under way also. Paige-Jewett has fallen into line and has sent out inquiries for some special machinery. The Continental Motor Corporation plans the purchase of some milling machines and drills.

Cadillac, Oakland, Oldsmobile, General Motors Truck, Buick and Chevrolet, with price reductions made public, are machining up for expectant sales. Oakland is making some changes in its assembly line. An expansion program in which some $850,000 will be spent has been started at the malleable iron plant of the General Motors Corporation at Saginaw.

Smaller dealers in tools are feeling the prosperity, and the outlook is for the best fall business this city has known for some years.

Engineers to Speak at Safety Congress

The preliminary program for the fourteenth annual safety congress to be held at Cleveland, Sept. 28 to Oct. 2 has just been released by the National Safety Council, under whose auspices the meeting will be conducted. The sessions have been so arranged as to give the various industries interested in safety work separate times for the study of their special problems.

The automotive section will meet in the Statler Hotel on Tuesday, Sept. 29. This session will be presided over by R. F. Thalner, safety director of the Buick Motor Co. The speakers will be C. C. Carlton, of the Motor Wheel Corporation; Dr. Frank Allport, of Chicago; W. F. Dittmer, of the Westinghouse Electric and Manufacturing Co.; and C. A. Hill, of the Muller Metal Co.

The metals section will meet in three sessions on the same day. The first session, on education, will be a symposium of fundamentals of industrial safety education. M. E. Danford, works manager of the American Rolling Mill Co., will lead the discussion. Other speakers will be Phillip Stremmel, of the National Enameling and Stamping Co., and A. T. Morey of the Commonwealth Steel Co.

The second session will take up mechanical problems. Speakers will be J. A. Hughes of the Carnegie Steel Co., E. H. Ballard, of the General Electric Co., and Dr. L. W. Chaney, of the U. S. Department of Labor. The third session will be a round table conference at which pictures of new safety devices will be shown by John A. Oartel, of the Carnegie Steel Co.

Cost of Living Gains Slightly in July

The cost of living index number of the National Industrial Conference Board, as of July 15, 1925, according to a survey just completed, is found to be approximately 2 per cent higher than that of March 15, 1925. Slightly more than half of this increase occurred between June 15 and July 15.

Between March and July, 1925, there were average increases in the cost of food, 6 per cent; clothing, 1.1 per cent, and light, seven-tenths of one per cent. Average shelter and fuel prices decreased 1.7 per cent and 3.3 per cent respectively; average sundries prices did not change in this period.

Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and July, 1925, the cost of living decreased 17.5 per cent. The increase in the cost of living since 1914 was 68.7 per cent.

Not to Force Standardization

A report to the effect that the Department of Commerce is working out a plan to police simplified practice and standardization agreements is denied vigorously by Secretary Hoover. There never has been a thought of anything other than to prompt industry to do these things for itself. Usually adherence to the simplified program is its own reward, but in the exceptional cases where producers have not lived up to the agreement, the industry itself, Mr. Hoover stated, has found little difficulty in securing compliance when the matter is taken up formally with the offending member.

To Study Iron Ore Deposits in Minnesota

Plans are being perfected for extensive co-operative work between the Bureau of Mines and the State of Minnesota on the concentration and beneficiation of low-grade iron ore. Dorsey A. Lyon, acting director of the bureau, has been in Minneapolis conferring with officials of the School of Mines and of the state experiment station. If the arrangement goes through, E. P. Barrett, one of the bureau's specialists, will be loaned to the state to direct the co-operative work.

News of the Automotive Industry

The Buick Motor Co. is operating on a schedule this month of 23,000 cars. All plants are in full operation, and working forces are being gradually increased, according to news reports. As a result of operating economies instituted during the past eighteen months, Buick is producing as many cars with 12,000 men as formerly with 19,000.

Celebrating its first anniversary since factory reorganization in July, 1924, the Apperson Automobile Co. established another record sales mark last month. Previously June, 1925, had exceeded totals for any month this year.

The preliminary statement of the Willys-Overland Co., for six months ended June 30, 1925, shows net profit of approximately $10,500,000, after ordinary taxes, depreciation, interest, and expenses of new models, but before federal taxes. This is equal to $47.62 a share earned on $22,049,500 preferred stock, and compares with $2,781,692, or $12.61 a share, in first half of 1924.

The Motor Wheel Corporation, of Detroit, reports last month's business the greatest July in the company's history, exceeding July, 1924, by 61 per cent.

Net earnings of the Timken-Detroit Axle Co. for the first half of 1925 were $522,000, after taxes, charges and preferred dividends, equivalent to 63 cents a share (par $10) earned on 823,920 shares of common stock.

The Auburn Automobile Co. declared a 100 per cent stock dividend on common (stock), increasing capital to $1,500,000 from $750,000. A quarterly dividend of 75 cents a share was also declared on the common stock.

The Peerless Truck and Motor Corporation, of Cleveland, proposes to do away with its holding company and its Virginia charter and reincorporate under Ohio laws. This step has in view the saving of large sums in taxes. Stockholders are called to a special meeting to be held Sept. 22, at Richmond, Va.

The Nash Motors Co. is breaking previous production records according to inquiries for steel and advices to the steel trade here. The company has a theoretical capacity of 410 cars a day at its Kenosha and Milwaukee plants but is now turning out 450 cars daily by working extra shifts and pushing production to the utmost.

The Hupp Motor Car Co. of Detroit, has produced 10,000 eight-cylinder cars since starting in production seven months ago.

Passenger car shipments from the Pierce-Arrow Motor Car Co.'s factory at Buffalo during June and July represent the greatest increase in passenger car business in the history of the company, according to President Myron E. Forbes. The increase in passenger car business for June, 1925, represented a gain of 622 per cent over June, 1924, while Pierce-Arrow business for July, 1925, showed a rise of 420 per cent over the same month of last year.

Business Items

A special meeting of the stockholders of the Niles-Bement-Pond Co. has been called for Sept. 1 at 15 Exchange Place, Jersey City, to vote on the proposition to change and reclassify the present common stock from 85,000 shares, par value $100, to 200,000 shares of common stock of no par. The present preferred stock will remain unchanged as regards dividends and preferences. Of the 200,000 shares of new no par common stock to be authorized 170,000 will be issued in exchange for the present $100 par stock on the basis of two new shares for one now held. It is said that larger stockholders requested this change.

The Air Reduction Sales Co., with executive offices at 342 Madison Ave., New York, has purchased the assets and assumed the liabilities of the Gas Tank Recharging Co., Inc. The latter company owned and operated acetylene plants at Milwaukee, Wis., and at Bettendorf, Iowa; and a carbide plant at Keokuk, Iowa. The sales and service of the combined companies will be immediately available to users of oxy-acetylene.

The Walraven Co., of Atlanta, Ga., machine tool and equipment jobbers, announces that it has been appointed exclusive distributor in the Atlanta trade territory for the Milburn combination cutting and welding torch, manufactured by the Alexander-Milburn Co.

The Treviston Co., manufacturer of tools, has moved its plant from Jamestown, N. Y., to Sherman, N. Y.

The plant formerly occupied by the U. S. Headlight Co., at Buffalo, N. Y., has been purchased and will be occupied soon by the Jewett Refrigerator Co., a concern which specializes in refrigeration plants in which electrical equipment is used. This purchase will give double the plant capacity.

The Linde Air Products Co., of New York, manufacturer and distributor of oxygen for welding and cutting, announces that its district sales office at Seattle is now located at 421 Railway Exchange Building, Seattle, Washington. O. H. Davenport is district sales manager.

The Harnischfeger Sales Corporation has been organized to handle the products of the Harnischfeger Corporation, of Milwaukee. Henry Harnischfeger heads the new firm.

The C. F. Bulotti Machinery Co., of 76 Main St., San Francisco, will move in September to a new location at 829 Folsom St.

The Cincinnati Shaper Co., of Cincinnati, Ohio, announces the arrangement of the following agencies: The Huey & Philp Hardware Co., of Dallas, Texas, has been appointed exclusive representative in central and western Texas. Woodward-Wight & Co., Ltd., of New Orleans, will handle the company's business in the New Orleans territory. Neff, Kohlbusch & Bissell, of 1045 W. Washington Blvd., Chicago, will handle the line of all-steel press brakes in the Chicago territory.

The Haynes Stellite Co., of New York, manufacturer of Stellite metal cutting tools and other articles of high-speed, rust and corrosion resisting alloys, has just completed concentration of the company's activities at its plant at Kokomo, Ind. All service in connection with the company's products will hereafter be extended direct from the plant. Headquarters for administration, sales and engineering activities will be at Kokomo, these being conducted under the direction of C. G. Chisholm, general manager.

Pamphlets Received

The Drill for Today. A 15-page, 5½ x 8-in. pamphlet, published by the Detroit Twist Drill Co., Detroit, Mich. It was designed primarily to set out the advantages of the twist drill produced by the rolled method, and machined with a varying angle of flute, but at the same time it gives a brief account of the evolution and development of the twist drill from its earliest stages.

What the Railroads Are Doing

"Outlook for the railroad business for the fall is very good," stated E. E. Loomis, president of the Lehigh Valley R.R. recently. "I have only had preliminary estimates of July earnings, but they were very much better than a year ago. Our earnings to date this year are well ahead of last year's, and this improvement should continue throughout the year."

A. H. Harris, chairman of the finance committee of the New York Central R.R., refused either to confirm or deny reports that the Central is seeking to acquire the New Haven's holdings of 51 per cent of the New York, Ontario & Western stock. In usually well informed circles, however, it is believed that the New York Central is very eager to acquire the O. & W.

The General Railway Signal Co. has received orders from the Southern Railway System for signaling material to be used in the installation of modern three-position semaphore signals on several hundred miles of Queen & Crescent lines, which extend from Cincinnati south.

Third quarter business of the American Locomotive Co., based on bookings which will form the operating profit statement for that period, will probably show a loss for the period of about $1,000,000. This is attributed principally to the exceedingly low operating rate of the plants. Recent report of the American Locomotive Co. for the first half of 1925 showed a profit of $212,718, or 85 cents a share on the 250,000 outstanding preferred shares.

Shipments of mining and industrial electric lomomotives in the quarter ended June 30 totaled 139 units, valued at $663,335, according to the Department of Commerce. This compares with 158, valued at $693,724, in the previous three months. For six months ended June 30, shipments were valued at $1,357,059, against $1,709,429 in the 1924 period.

A new type of internal combustion engine known as the "Whaley" engine has been developed and successfully tried in shops. The unit was built by the Sun Shipbuilding and Dry Dock Co., Chester, Pa. The American Locomotive Co. owns the right for use of this engine on rails in this country. The general patents are owned by the Whaley Engine Patents, Inc., for western hemisphere. Foreign rights are owned by the International Whaley Engine Corporation.

Final test will be made in the near future. The engine is applicable to marine, stationary and locomotive uses. Quite unlike the Diesel engine, it can be built to any size and power which is now occupied by steam units. Weight per horsepower of the Whaley engine is approximately the same as that of steam engines.

Personals

JOHN C. CHRISTIENSEN, president of the Cincinnati Gear Co., Cincinnati, Ohio, was knighted by King Christian of Denmark, while he was visiting in that country recently. The order bestowed was "Rider Daneboro," which means Knight of the Danish Flag. Mr. Christiensen sailed for home August 14.

W. J. TAYLOR, for the past four years general foreman at the Sparks shops of the Southern Pacific Ry., has been promoted to the position of general foreman of the Sacramento shops of the same company.

A. R. GILLHAM has resigned as managing director of Canadian Vickers, Ltd.

R. M. SCOTT has been appointed foundry manager of the Packard Motor Car Co., Detroit, succeeding Fred Erb. Mr. Scott was formerly connected with the Cleveland Punch and Shear Works.

E. J. OWENS has been appointed chief engineer for the St. John & Quebec Ry.

A. E. WARREN has been appointed general manager of the central region of the Canadian National Railways.

HAROLD SHADE has been appointed purchasing agent for the Diebold Safe and Lock Co., of Canton, Ohio. He was formerly associated with the Timken Roller Bearing Co.

ROBERT LANZING has resigned as vice-president and general manager of Nash-Cincinnati Motors.

WILLIAM T. OBER has been appointed manager of the Philadelphia office of the Thomas Electric Welding Co., of Lynn, Mass.

SAMUEL REA, president of the Pennsylvania Railroad, has announced his retirement from active participation in the management of that organization effective Oct. 1. Mr. Rea has been associated with the Pennsylvania lines for about fifty-five years.

A. C. FIELDNER has been appointed chief chemist of the Bureau of Mines. He was formerly in charge of the Pittsburgh office.

GENERAL C. L'H. RUGGLES, Assistant Chief of Ordnance, has returned from a tour of duty in Europe. He visited all the important European capitals to observe current activity and he also served as American delegate to the conference at Geneva for the supervision of international trade in arms, ammunition and equipment of war.

FRED AUTY has been appointed production manager for Drying Systems, Inc., of Chicago.

ARTHUR M. WATKINS has joined the sales staff of the Vandyck Churchill Co., of New York. Mr. Watkins was formerly New York sales manager for the Consolidated Machine Tool Corporation of America.

F. W. JAEGER, agent and exporter of machine tools and shop equipment, sailed on Aug. 15 for a six weeks' trip to Europe.

H. J. VOLZ has been appointed sales representative in the Illinois territory for the E. L. Essley Machinery Co., of Chicago. Mr. Volz was formerly associated with the Warner & Swasey Co.

CHARLES E. PYNCHON has resigned as manager of the machinery department of Joseph T. Ryerson & Son, Inc., of Chicago.

Obituaries

CHARLES H. KINGSBURY for many years representative of the Niles-Bement-Pond Co., in the New England territory, died at his home in Quincy, Mass., on Aug. 7. He was 62 years old.

R. H. HATTON, for twenty-five years an engineer with the Provo Foundry and Machine Co., at Provo, Utah, died on Aug. 12.

WILLIAM H. OUTTRIM, electrical engineer at the River Works plant of the General Electric Co., died at his home in Swampscott, Mass., on Aug. 17. He was 61 years old.

CHARLES H. LEAP, 50 years old, superintendent of the steel department of the American Car and Foundry Co., died at Jeffersonville, Ind., on Aug. 12.

JACOB FISHER, 91 years old, credited with having originated a number of improvements for farm machinery now universally used, died on Aug. 10 at his home in Delphi, Ind.

THEODORE P. JACOBS, 78 years old, head of the Jacobs Company, of Indianapolis, and at one time owner of the Indianapolis Pattern Works, died on Aug. 14 at his home. He spent several years in South America where he was superintendent of motive power for several railroads.

SIR ADAM BECK, chairman of the Ontario Hydro Electric Power Commission, and father of the hydro system in that province, died at his home in London, Ontario, on Aug. 15, in his 68th year. He had been suffering for several months and had only recently returned from Baltimore where he underwent special treatment in a hospital. The beginning of Sir Adam's interest in the supply of cheap electric power to the people of Ontario began in 1903, when he was appointed a commissioner to investigate the development and distribution of electric power from Niagara Falls. In 1906, as minister without portfolio in the provincial government, Sir Adam introduced a power bill in the legislature, creating the Hydro Electric Power Commission. He was appointed chairman of the commission in June of that year. This position he continued to hold up to the time of his death.

ROBERT MITCHELL BURTON, of Cincinnati, president of the American Laundry Machinery Co., died Aug. 10, in his summer home in Wianno, Mass., at the age of 61 years.

DANIEL W. DRISCOLL, president of the Driscoll Transmission Co., died in New York City on Aug. 2. He was 51 years old. Mr. Driscoll was known for his invention of a gearless and beltless device for regulating the speed of machinery.

Trade Catalogs

Electric Motors. Century Electric Co., St. Louis, Mo. Form No. 571 is a folder issued to bring out the quietness of the ½-hp. to 40-hp. sizes of the Century repulsion-start, induction, single-phase motors.

Motor Starting Switches. The Trumbull Electric Manufacturing Co., Plainville, Conn., has issued Bulletin No. 2 to describe the "Circle T" motor-starting switches of the tumbler type, for fractional hp. motors and for lighting circuits.

Forthcoming Meetings

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Ill., Sept. 2, 3 and 4. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. William Hall, secretary and treasurer, 1061 W. Wabash St., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition. Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

Association of Railway Supply Men. Annual convention and exhibition. Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. Earl E. Thulin, secretary, the Duff Manufacturing Co., 715 People's Gas Bldg., Chicago.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

Production Meeting Society of Automotive Engineers. Sept. 14, 15 and 16. In conjunction with American Society for Steel Treating. John Younger, chairman; C. F. Clarkson, secretary, 29 West 39th St., New York City.

National Safety Council. Fourteenth annual safety congress, Cleveland, Sept. 28 to Oct. 2. A. A. Mowbray, director, 168 N. Michigan Ave., Chicago.

American Gear Manufacturers' Association. Semi-annual meeting, Oct. 1, 2 and 3, West Baden Springs Hotel, West Baden, Ind. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Motor and Accessory Manufacturers' Association. Fall meeting, Prince Edward Hotel, Montreal, Canada, Oct. 14 to 16. M. L. Heminway, general manager, 250 West 57th St., New York.

National Industrial Advertisers' Association. Annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., Oct. 19 to 21. W. A. Wolff, chairman, the Western Electric Co., 195 Broadway, New York.

Management Week. Conducted jointly by five societies—The American Society of Mechanical Engineers, The American Management Association, The National Association of Cost Accountants, The Taylor Society and the Society of Industrial Engineers. Week of Oct. 19 to 24. W. L. Conrad, of the A. S. M. E., is chairman of the joint committee.

American Welding Society. Exposition of welding equipment and accessories, Massachusetts Institute of Technology, Cambridge, Mass., Oct. 21, 22 and 23. R. L. Browne, chairman, 141 Milk St., Boston, Mass.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel.—Pig-iron prices have shown little change during the past sixty days; buying is confined to small tonnage lots; rising price of coke may later affect market. Scrap is firm at current quotations. Steel demand is running largely to pipe, wire products, cold drawn shafting and screw stock. Mill operations are heavier now than at any time since spring. Shapes remain unchanged from last week's level of $1.80@$2 per 100 lb., Pittsburgh mill, Plates are $1.80@$1.90 and bars $2 per 100 lb. at mill. The former is slightly weaker and the latter firmer than on Aug. 14.

Non-Ferrous Materials—Copper and zinc are ¼c. and lead ⅛c. per lb. above the Aug. 14 levels in New York warehouses. Fabricated brass and copper products rose in Cleveland during the week. Linseed oil advanced ½c. per gal. and wiping cloths ½c. per lb. in Chicago, between Aug. 14 and 21.

(All prices as of Aug. 21)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$23.05
Northern Basic	22.27
Southern Ohio No. 2	22.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	18 50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.26
Virginia No. 2	29.17
Basic	21.16
Grey Forge	.....
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.77
Basic	20.77
Bessemer	20.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00
Cleveland	4.90@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.30@2.40	3.89	3.10	3.50
No. 12	2.35@2.45	3.94	3.15	3.55
No. 14	2.40@2.50	3.99	3.20	3.60
No. 16	2.50@2.60	4.09	3.35	3.70
Black				
Nos. 17 to 21	2.95@3.00	4.15	3.70	3.80
Nos. 22 to 24	3.00@3.05	4.20	3.75	3.85
Nos. 25 and 26	3.05@3.10	4.25	3.80	3.90
No. 28	3.15@3.20	4.35	3.90	4.00
Galvanized				
Nos. 10 and 11	3.20@3.25	4.35	4.10	4.00
Nos. 12 to 14	3.30@3.35	4.45	4.20	4.10
No. 16	3.45@3.50	4.60	4.35	....
Nos. 17 to 21	3.60@3.65	4.75	4.50	4.40
Nos. 22 to 24	3.70@3.80	4.90	4.65	4.55
No. 26	3.90@3.95	5.05	4.80	4.70
No. 28	4.20@4.25	5.35	5.10	5.00

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches — External	Diameters Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	....	4.00@4.65
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.05	....	....
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	8.25	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	3.80	3.60
Cold drawn flats, squares	4.65	4.30	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	60%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.25
Tin, 5-ton lots, New York			58.75
Lead (up to carlots) E. St. Louis	10.25	New York	10.75
Zinc (up to carlots) E. St. Louis	7.65	New York	8.50

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	19.00	20.00	....
Copper sheets, base	22.75	22.75	22.75
Copper wire, base	20.25	17.00	16.75@17.00
Copper bars, base	21.87½	21.50	21.87½
Copper tubing, base	24.75	25.50	24.75
Brass sheets, base	19.12½	19.00	19.12
Brass tubing, base	23.75	23.75	23.75½
Brass rods, base	16.87½	16.87½	16.87
Brass wire, base	19.62½	22.50	19.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28.00	28.00	28.03
Zinc sheets (casks)	11.25	11.50	10.75
Solder (½ and ½), (case lots)	39.50	38.00	38@42
Babbitt metal (83% tin)	60.00	69 25	58@63
Babbitt metal (35% tin)	28.00	20.50	30@35
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.50@12.75	12.00	12.50@13.00
Copper, heavy, and wire	12.00@12.37½	11.75	11.75@12.25
Copper, light, and bottoms	10.00@10.37½	10.00	10.75@11.25
Heavy lead	8.00@ 8.37½	7.25	8.50@ 9.00
Tea lead	6.50@ 7.00	4.75	7.00@ 7.50
Brass, heavy, yellow	7.50@ 8.00	7.50	8.00@ 8.50
Brass, heavy, red	8.00@ 8.50	9.75	9.75@10.25
Brass, light	6.25@ 6.50	6.00	7.50@ 8.00
No. 1 yellow rod turnings	8.25@ 8.75	8.00	8.00@ 8.50
Zinc	4.75@ 5.25	4.00	4.50@ 5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.50
"A" Grade:				
IC,	14x20	8.85	9.40	9 50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.18
Cotton waste, colored, per lb.	.10@ .15½	.18	.17
Wiping cloths, 13¼x13¼, per lb	.17	36.00 per M	.11½*
Wiping cloths, 13¼x20½, per lb.	....	45.00 per M	.11½*
Sal soda, per 100 lb. keg	2.25	2.25	2.75
Roll sulphur, per 100 lb. keg	3.75	3.75	4.50
Linseed oil, per gal., 5 bbl. lots	1.08	1.14	1.03
Lard cutting oil, 25% lard, per gal.	.55	.50	.72
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40%	40%	30–10%
Heavy grade	30–10%	30–10%	30–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	50%
Second grade	50–10–5%	60–5%	50–10%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold finished shafting	per lb.	.0415	.0415	.0415
Brass rods	per lb	.1687½	.1587½	.1475
Solder (½ and ½)	per lb.	.395	.395	.375
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40%	40%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	50%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.46	$5.84	$5.00
Emery paper	10.71	11.00	11.90
Emery cloth	29.48	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.41	1.40
Cloth	3.55	2.67	3 55
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		2.90@3.00
Coke, prompt foundry, Connellsville	per net ton		4.00@4.50
White lead, dry or in oil	100 lb. kegs	New York, 15.75	
Red lead, dry	100 lb. kegs	New York, 15.75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1½ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.60@3.75 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{9}{16}$-in. and smaller and 65% for ⅝-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ⅞-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb.; less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal, will receive bids until August 31st for sash sticking machine, band resaw machine, etc.

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal, will receive bids until September 1st for drills, taps, pipe cutters, pneumatic chipping tools, tinners' shears, etc.

Ill., Chicago—J. E. Nelson & Sons, 3240 South Michigan Ave.—one 50 ton 87 ft. 5½ span 6 motor crane, two 15 ton 46 ft. 6½ span 3 motor cranes for shops at Huntington, W. Va.

Mass., Boston—I. S. Stone, 53 State St.—miscellaneous tools and equipment for repair and service garage at Magoun Sq., Sommerville.

Mass., Brockton — M. Goodman, 25 Pleasant St.—repair tools and equipment for extensive garage on Main St.

Mass., Holliston—Box 122, R. F. D.—garage equipment including lathe, wrecking crane and air compressor.

Mich., Muskegon — West Michigan Steel Foundry Co., West Western Ave. — air compressor, 2 stage 500 ft. or more capacity, 72 in. disc. grinder with blower.

N. Y., Buffalo—The Buffalo Wire Works Co., 316 Terrace St.—equipment for new plant for the manufacture of wire products.

N. Y., Buffalo—F. Edwards, 573 Front Ave.—No. 5, 6 or 7 Morgan box mailing machine with side arm.

N. Y., Buffalo—C. A. Puff, 222 North Division St.—small tools and equipment for garage and repair shop.

Pa., Corry—Ajax Iron Works—overhead electric crane and runway.

Pa., Latrobe—Latrobe Electric Steel Co. —overhead electric traveling crane.

Pa., Monongahela City—Armstrong Steel Co.—centerless grinders, bar straighteners.

Wis., Milwaukee—A. O. Smith, 27th and Keefe Ave.—two 50 ton traveling cranes also spot welders.

Ont., Hawkesbury—Rochon & Co., Main St. E. (auto repairs, etc.)—lathe and drill press.

Ont., Niagara Falls—Oneida Community Silver Co. (silverware manufacturers)—equipment for plant.

Ont., Stratford—Federal Combustion Corporation—machinery for the manufacture of oil burning equipment.

Que., Lachute — J. P. Paquin—miscellaneous garage tools.

Que., Plantagenet — A. Robinson—tools and equipment for repair and service garage.

Que., St. Fiblen—A. Giguere & Fils (sawmill)—rip saw, band saw and other machinery.

Opportunities for Future Business

Calif., San Francisco—J. A. Roebling & Sons Co., 646 Folsom St., will build a 2 story plant for the manufacture of wire rope, etc., at 16-17 DeHaro and Carolina Sts. Estimated cost $250,000.

Conn., Watertown—Watertown Mfg. Co., awarded contract for the construction of a 1 story, 40 x 50 ft. factory for the manufacture of insulators, and a 30 x 60 ft. boiler house on Echo Lake Road. Noted June 11.

Fla., Jacksonville—C. L. Capps Co., 1224 East Adams St., plans the construction of a plant including a machine shop, and foundry department for the casting of brass and iron mouldings on East 8th St.

Fla., St. Augustine—Florida East Coast R.R., 120 Broadway, New York, W. G. Brown, St. Augustine, Ch. Engr., awarded general contract for the construction of railroad shops. Estimated cost $3,000,000. Battey & Kipp, Inc., 123 West Madison St., Chicago, Ill., Engrs.

Ill., Granite City—St. Louis Coke & Iron Co., 117 North 4th St., St. Louis, under plans of reorganization will have $2,000,000 available for the construction of a new blast furnace and power plant addition to plant here.

Ind., Indianapolis—Symons Bros. Co., is having plans prepared for the construction of a 1 story, 150 x 860 ft. and 60 x 100 ft. foundry and milling plant. Lamboy Co., 3005 Plankinton Bldg., Engr.

La., New Orleans—W. Strauss & Co., c/o S. S. Joy, 2001 West Pershing St., Chicago, Ill., Archt., is having plans prepared for the construction of a 16 story, 90 x 200 ft. hotel including a commercial garage at University Place and Common St. Estimated cost $1,500,000.

Md., Baltimore — Bd. of Awards, will receive bids until September 9th for the construction of addition to 3 story 101 x 205 ft. school including a 1 story, 100 x 180 ft. shop at Warren and Battery Aves. L. R. White, Hearst Tower, Archt.

Md., Baltimore—Flynn & Emrich Co., R. C. Stewart, Pres., Holliday and Saratoga Sts., is having plans prepared for the construction of a 1 story, 100 x 260 ft. foundry on 25th St. between Caton and Garrett Aves. Estimated cost $125,000. W. S. Austin, Maryland Trust Bldg., Engr.

Your machine-tool wants inserted here free of charge

Address
BUSINESS NEWS DEPARTMENT
McGRAW-HILL CO., INC.,
10th Ave. at 36th St., New York.

Mass., Boston—O. F. Farley, 27 State St., will build a 1 story repair and service garage on Brighton Ave. Estimated cost $40,000. F. A. Norcross, 46 Cornhill, Boston, Archt.

Mass., Brockton — M. Goodman, 25 Pleasant St., is receiving bids for the construction of a 2 story, 78 x 240 ft. garage on Main St. Estimated cost $175,000. M. L. Minor, 60 Pemberton Sq., Boston, Archt.

Mass., Chelsea (Boston P. O.)—Francis & Badger Motor Co., 279 Broadway, awarded contract for the construction of a 1 story repair and service garage at Broadway and Carson St. Estimated cost $50,000. H. F. Kellogg, 110 State St., Boston, Archt. Noted July 30.

Mass., Framingham—Barber-Colman Co., manufacturers of textile machinery, hobbing machinery, hobs, milling cutters, etc., awarded contract for the construction of a 1 story, 100 x 122 ft. office and service building. Estimated cost $40,000.

Mass., Hyde Park (Boston P. O.)—Dedham & Hyde Park Gas & Electric Co., 1242 River St., awarded contract for the construction of a 1 story garage and repair shop on River St. Estimated cost $50,000.

Mass., West Newton (Boston P. O.)—J. Rooney, 515 Waltham St., is receiving bids for the construction of a 2 story, 50 x 80 ft. repair and service garage on Waltham St. Estimated cost $40,000. Private plans.

Mo., St. Louis—Barton Mfg. Co., Waco, Tex., is having preliminary plans prepared for the construction of a 2 story factory for the manufacture of rubber stamps at Kings Highway and Brown St. here. Estimated cost $100,000.

Mo., St. Louis—Chandeysson Electric Co., 4092 Bingham Ave., awarded contract for the construction of a 50 x 120 ft. factory on Bingham Ave. Estimated cost $50,000.

N. J., Newark—Sears Roebuck Co., 106 West Randolph St., Chicago, Ill., has leased 38 acres at Port Newark and plans the construction of a group of buildings including a 100 x 200 ft. planing mill, 120 x 350 ft. shop and mill work factory, 120 x 480 ft. ready cut factory, 120 x 350 ft. portable house factory, two 500 ft. sorting tables, dry kiln, etc. Estimated cost $1,500,000.

O., Ashland—F. Myers & Bro. Co., P. A. Myers, Pres., is having plans prepared for the construction of a 5 story, 70 x 180 ft. plant for the manufacture of pumps and gears. Estimated cost $300,000. Lockwood, Greene & Co., Hanna Bldg., Cleveland, Archts.

O., Cleveland—Grabler Mfg. Co., W. S. Bayer, Secy., 6505 Broadway, awarded contract for the construction of a 6 story, 60 x 220 ft. plant for the manufacture of plumbing supplies including a machine shop, etc. Estimated cost $300,000.

Pa., Aspinwall (Pittsburgh P. O.)—John F. Casey Co., will build a 1 story, 72 x 100 ft. addition to shop. Private plans.

Pa., Bethlehem — Holland Furnace Co., Holland, Mich., awarded contract for the construction of a factory and office building here. Estimated cost $195,000.

Pa., Latrobe—Latrobe Electric Steel Co., is receiving bids for the construction of a 1 story, 60 x 400 ft. addition to electric steel plant. Estimated cost $100,000. Private plans.

Pa., New Brighton—Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, is having preliminary plans prepared for the construction of a 5 story, 30 x 50 ft. addition to chemical building in Beaver County here. Estimated cost $50,000. B. H. Prack, Martin Bldg., Pittsburgh, Archt.

Pa., Pittsburgh—Jones & Laughlin Steel Corporation, Jones & Laughlin Bldg., will build a 1 story, 135 x 325 ft. bar bending plant on 2nd Ave. Private plans.

Pa., Wilkes-Barre—Hazard Mfg. Co., 81 East Ross St., is having plans prepared for the construction of a plant for the manufacture of wire rope. Estimated cost $50,000. McCormick & French, Second National Bank Bldg., Archts.

R. I., Providence—Providence Gas Co., Turks Head Bldg., awarded contract for the construction of a 2 and 3 story, 200 x 300 ft. shop building and garage at Dexter and Waldo Sts. Noted Apr. 23.

Wash., Longview—Weyerhauser Timber Co., Tacoma Bldg., Tacoma, plans the construction of 3 mills, cedar, fir and hemlock, on its 700 acre site here.

W. Va., Huntington—H. E. and E. C. Hines, plans the construction of a 3 story, 185 x 185 ft. garage on 5th St. Estimated cost $150,000. Meanor & Handloser, Robson-Prichard Bldg., Archts.

Wis., Milwaukee—A. O. Smith, 27th and Keefe Aves., plans the construction of a factory for the manufacture of pressed steel products on 27th St. E. W. Burgess, c/o owner, Archt. and Engr.

Wis., Milwaukee—South Side Malleable Casting Co., 14th and Windlake Aves., awarded contract for the construction of a 1 story, 179 x 186 ft. addition to foundry on 14th Ave.

Ont., Niagara Falls—Oneida Community Silver Co., awarded contract for the construction of addition to plant for the manufacture of silverware. Estimated cost $100,000.